DOCUMENT RESUME

ED 338 484 SE 052 191

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TITLE Learning To Program in BASIC through the Use of Graphics.
PUB DATE Jun 90
NOTE 181p.; M.S. Thesis, New York Institute of Technology.
PUB TYPE Dissertations/Theses - Masters Theses (042) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC08 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Computer Graphics; *High Risk Students; High Schools; *Instructional Improvement; Instructional Materials; Intervention; Learning Activities; *Learning Strategies; Mathematics Education; Mathematics Instruction; Potential Dropouts; Program Descriptions; *Secondary School Mathematics; Special Needs Students; Teaching Methods
IDENTIFIERS *BASIC Programing Language; *Instructional Systems Design

ABSTRACT

Many organizations and experts in the field of mathematics education have recommended the inclusion of technology and, more specifically, computer programing within the course of study for the teaching of school mathematics. The incorporation of these recommendations with respect to the teaching of remedial mathematics poses a problem, since students, who have demonstrated difficulties with arithmetic in the past, tend to find the process of programing very much more difficult due to its abstract nature. This project details an examination of a computer-based mathematics learning activity for low-achieving and/or at-risk 10th, 11th, and 12th grade inner-city students (n=14). Following the procedural outline of the Instructional Systems Design Model, the project makes use of the BASIC Programing Language, along with supplementary materials, to foster the motivation necessary for the students to reach the project's objective, precisely that each student create a program that will produce a graphic image which is a reflection of what that student had planned. This report includes the following chapters: (1) an introduction detailing background, rationale, purpose, definitions, assumptions, limitations, and methods; (2) an analysis of student needs, instructional goals, previous literature, existing course materials, and a developmental plan; (3) the design of task analysis, instructional objectives, and assessment specifications; (4) the schema for learning activity development and review; (5) the plan for implementation of materials for instruction and data collection; (6) a summary of methods and procedures, conclusions, and recommendations; and (7) 11 appendices which include the student survey, the task analysis form, the project plan outline, the performance objectives, the instructional strategy, the instructional materials, the evaluation materials, specific high school lesson plans, evaluation results, improved instructional and evaluation materials, and an instructional materials locator. The foremost result was that students involved in the project displayed significant improvement in attendance patterns, which result directly manifested itself in an overall improvement in assignment completion, as well as moderate increases in achievement levels. (19 references) (JJK)

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THE SCHOOL OF MEDIA AND ARTS

of

NEW YORK INSTITUTE OF TECHNOLOGY

announces the

Final Examination

of

Timothy J. Connor

for the degree of

MASTER OF SCIENCE

in

TRAINING AND LEARNING TECHNOLOGY

Learning to Program in Basic Through the Use of Graphics

Abstract

This project represents an examination of the analysis, design, development, implementation, and evaluation of an instructional learning activity for lower achievers or at-risk tenth, eleventh, and twelfth grade students in writing computer programs in conjunction with learning mathematics. However, to incorporate this idea with teaching remedial mathematics posses a problem. Students who have had difficulty with plain arithmetic find the process of programing very difficult due to its abstract nature. This difficulty can lead to a significant level of absenteeism and failure.

The designer of this project worked on the premise that if a concrete method of introducing programming could be found, the students would comprehend the philosophy of programming at a higher degree. He felt that this understanding would carry over to latter assignments in a computer mathematics course where the students would achieve a higher degree of proficiency.

The designer decided to introduce BASIC language programming on the Apple IIe computer using low resolution graphics. Using the procedures of the Instructional Systems Design Model, the author created a unit of instruction which lead the students to learn computer programming. The students were encouraged to produce designs over which they had full control from start to finish.

The Results of the project showed a marked improvement in students attendance and a overall improvement in the Computer Mathematics course.

Tuesday, September 25, 1990 at 4:30 p.m.

in

Conference Room, French Chateau
Old Westbury Campus
Old Westbury, NY

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SE 052 191

LEARNING TO PROGRAM IN BASIC THROUGH THE USE OF GRAPHICS

a

THESIS/PROJECT

by

TIMOTHY J. CONNOR

submitted to the faculty of the
School of Media and Arts

of

NEW YORK INSTITUTE OF TECHNOLOGY

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

TRAINING AND LEARNING TECHNOLOGY

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LEARNING TO PROGRAM IN BASIC THROUGH THE USE OF GRAPHICS

by

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B.S. , 1984, Oneonta State University of New York

A Thesis/Project

Submitted to the Faculty of the

School of Media and Arts

Of New York Institute of Technology in partial satisfaction of the requirements for the degree of

Master of Science

June 1990

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Acknowledgement

I would like to thank Dr. Harry Burggraf, my advisor for all the assistance in writing this paper. I also want to especially thank my family for putting up with me throughout the entire process of this project.

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CHAPTER 1

INTRODUCTION

Overview

In an era in which the United States is quickly changing from an industrial work force to a service and technological work force, the need for improved mathematical skills is essential. The study of mathematics is no longer being taught to tune minds for other applications but rather as an essential skill needed to be employable in our society. The Conference Board of Mathematics and Science in September 1982 addressed this point in a meeting entitled, The Mathematical Science Curriculum K-12: What is Still Fundamental and What is Not. Among many of the suggestions and recommendations presented are:

Students should use calculators and computers both to develop concepts and to do tedious computations.

Students should avoid the tedious repetition of systematic methods for solving problems by doing them a few times and then programming a computer to do them.

Students who are not necessarily talented in Mathematics and not headed for careers in Science and Technology will gain a fresh outlook on Mathematics through the use of computers as mathematical tools and instructional media.

Students should use computer graphics packages to get a visual sense of geometric concepts and transformations.

These recommendations for increased use of computers in the mathematical curricula are supported by the National Science Board Commission on Precollege Education in Mathematics, Science and Technology

in the report Educating Americans for the 21st century (1988) and in the National Council of Teachers of Mathematics report An Agenda for Action: Recommendations for School Mathematics of the 1980's (1988).

The New York State Regents Action Plan calls for a required second year of mathematics by presenting a computer mathematics course as an option for a local diploma. The course should include mathematical lessons in a regular classroom as well as computer related activities in a computer laboratory. The New York City Board Of Education created a curriculum which the New York State Education Department's Bureau of Mathematics has approved. The Curriculum is outlined in Computer Mathematics: An Introduction (1986).

Background

The curriculum is the basis for the Computer Mathematics course offered at Sarah J. Hale High School in Brooklyn, New York for tenth, eleventh and twelfth grade students in need of a second year of mathematics. The title of the course is Mathematics/Computer Instruction 1 referred to here after as MCI 1. The Main focus of this course is problem solving using general mathematics as a basis. The students work with a mathematic concept then write programs on the computer using the language BASIC to solve problems involving the concept. To do this the students must break the problem down into its component parts which they then translate into a computer language. This process evokes genuine problem solving skills.

Problem solving skills are a needed commodity in our work place and therefore an appropriate learning activity. The students that are in MCI 1 are working towards a local diploma rather than a regents diploma and in general are lower-achievers or at-risk students. From informal classroom surveys, most students do not like mathematics and few have worked on a computer.

The few that have worked on the computer have only played games or used the computer as a word processor.

Statement of the Problem

The challenge is to motivate the students to want to learn BASIC programming. This will be attempted by teaching the students programming by using the Apple IIe's capabilities in Low Resolution Graphics. The problem incurred while teaching this course is that many students can't grasp the abstract concept of programming the computer. Since computer programming plays an integral part in the course, it is impossible to proceed with the curriculum until the majority of the class can program in the language BASIC. In order to accommodate this need, four weeks must be spent teaching introduction to programming even though the existing curriculum allows only one week to accomplish this task. This causes disillusionment and eventually rejection of the course of study.

Purpose of the Project

The purpose of the project is to motivate the students to want to learn the computer language BASIC. It is the intention of the author that the lessons implemented will enable the student to create a program that will produce a graphic image on the monitor that will reflect an image that the student had planned. The experience the students have with graphics should stimulate their curiosity of the language, thus creating an atmosphere of self-motivation.

Definition of Terms

The following terms are defined for specific use in this project.

At-Risk Student - A person who has social or academic problems which cause a low self esteem, a poor cultural aspirations and life experiences.

Computer - An Apple IIe machine.

BASIC - A popular computer language: Beginners' All-purpose Symbolic Instruction Code.

Low Resolution Graphics - The display of graphics on the Apple IIe using the display screen as an area of 40 columns wide by 40 rows high. Any of 16 colors are available.

Assumptions

That the students receiving the training on Apple IIe Low Resolution Graphics will be enrolled in MCI 1.

That the students will have no experience with computer programming.

That the students will have access to an Apple IIe computer with a maximum student/computer ratio of 2:1.

Limitations

That the time allotted to implement this project not exceed two weeks. This is by directive of the Assistant Principal of Mathematics of Sarah J. Hale High School. This is because it diverts from the curriculum.

That the instruction is created for MCI 1 students at Sarah J. Hale High School in Brooklyn, New York. The material may not be suitable for use in other organizations, circumstances, times or countries without appropriate modifications.

Method and Procedures

The method and procedures used in this project are based on the instructional systems design (ISD). The ISD model is comprised of five phases which are: analysis, design, development, implementation, and evaluation.

Analysis

The author, as a teacher of MCI 1, recognized a need to motivate the students while introducing BASIC programming. Following the guidelines of Dick and Carey (1985), a needs analysis was performed to identify the need for instruction. This is accomplished by performing a job task analysis, target population analysis and identifying organizational constraints on the instruction. Once a definite need of instruction was determined, instructional goals were identified. A search of existing materials was performed and though there are a number of existing sources of materials, none fully apply to the area in question.

Design

The design stage uses the job task analysis performed in the analysis stage to write the instructional analysis and instructional objectives. The primary resource in the writing of the performance objectives was Mager (1984). The objectives are grouped into a logical order to establish a smooth learning environment. Entry behaviors are established, learning activities and test questions are created from the performance objectives and a training plan was developed.

Development

The development of the instruction and the learning materials were based on Gagne's (1985) nine instructional events. The media used in the instructional design were printed and computer generated. The media were selected using the method suggested by Anderson (1983). The instructional technique incorporated lecture with laboratory work. This was decided, in

part, due to the fact that the existing curriculum, which this project is to enhance, is designed in this manner. The materials designed will be tested in a one-on-one environment and any part of the instruction within which troubles arises will be revised.

Implementation

The materials designed in the preceding sections will be delivered to a small group which possesses characteristics of the target population. Once revisions have been made, the materials will be presented to the target population. The students will be tested and data will be collected to support the evaluation of the project.

Evaluation

In the evaluation phase of the project there are two types of evaluation that will take place. Formative evaluation is used to ascertain the effectiveness and efficiency of the materials as they relate to the instructional goal and performance objectives. The data collected in the formative evaluation is used to make revisions on the instruction to make the lesson effective. The evaluation will take place at three separate times in the one-on-one trial, small group trial and the field test. Summative Evaluation is used to determine if the instruction is effective. The guide used in the summative evaluation are four levels of evaluation: reaction, learning, behavior, results/impact. The summative evaluation phase answers the question, "has this instruction made a difference in student learning — a difference that accomplishes a worthwhile purpose" (Gagne, 1985).

Summary

Many organizations and experts in the field of mathematics education have recommended the use of computers, and more specifically computer programming in the teaching of mathematics. The problem is that many

students enrolled in MCI 1 have difficulty with computer programming, because they can't visualize the abstract nature of the subject. For these students the computer is either a machine that does things for them, such as playing games, or a machine that knows everything. The students quickly become irritated with the computer when they can't communicate effectively with the computer. As a result, they will not allow the concept of programming a chance. Due to there inability to communicate effectively with the computer, many students are disillusioned with the computer early in the term and fall behind in the course work. The process used in this project follow the design of the instructional system design model. In the analysis phase of the project, it was determined that a need to motivate the students' desire to learn to program the computer was evident. The design phase established the objectives. Using Gagne's nine instructional events, the instructional materials and evaluation tools where created. The formative evaluation was conducted and revisions where made. The target population was then presented with the materials and a summative evaluation was performed.

CHAPTER 2

ANALYSIS

Introduction

The first step in constructing a block of instruction using instructional system design is analysis. The project that the author performed the analysis is geared to instruct at-risk, inner-city high school students to learn how to write computer programs in BASIC. There are four stages involved in the analysis of the project. The first stage involves conducting a needs analysis. The needs analysis defines what must be taught, who is to be trained, and how the instruction should be attempted. This is accomplished by performing a job task analysis to determine and identify what training is needed. The author performed the needs analysis by conducting a student survey and reviewing the attendance records of the course. Step two is the definition of the instructional goals. In this step the goals will be stated and the purpose of the instruction is discussed. A review of the literature and materials is the third stage of the analysis. The final stage of the analysis phase of the project is the planning of the design of the project and creating a time line for the project and calculating a budget.

Needs Analysis

The need for a change in the instruction was determined in MCI 1 after the instructors of the course observed a decline in attendance and thus in performance. In direct response to this decline, a review of past attendance records of the course was performed and a student survey was administered in order to determine the students' feelings as to what was right and wrong with the course. The review of the attendance records showed a pattern in

the rate of cutting and absenteeism after the first marking period. The review compared the attendance records of the first and the second marking period. The results show a substantial increase in the rate of absenteeism as the term progressed. The overall results of the term were determined from the average of the three marking periods. All of the information was found in the attendance records in the Attendance/Cutting Office. A chart summary of the attendance review can be found in Table 1.

Table 1

Course Attendance Survey

		1 st. Marking Pd.		2nd Marking pd.		Overall	
Term	#st.	%abs.	%cut.	%abs.	%cut.	%abs.	%cut.
Fall'87	37	23%	10%	46%	51%	37%	46%
Spg'88	48	18%	09%	43%	35%	36%	35%
Fall'88	36	21%	14%	48%	55%	38%	47%
Overall	121	21%	11%	46%	47%	37%	43%

The student survey form is found in Appendix 1. The survey show results that students can grasp the mathematical concepts being presented in the course, but programming is difficult for them to do. The main reason for the difficulty was they didn't know what to expect from the computer and didn't understand how the results the computer displayed were determined. The students who offered suggestions for change suggested getting rid of programming because it was too difficult to figure out, and even when the programs did give an answer, many did not understand how the result had been determined. The use of graphics was decided upon after a demonstration was made to the class. The students were also presented with

a printout of the program that created the demonstration as well as an explanation of what had to be done. The students were asked in the survey if they would like to attempt to create their own pictures. Of the students shown the demonstration, all fourteen wanted to learn how they could make pictures, even though the amount of work was likely to increase.

Job Task Analysis

Five main tasks were identified as required instruction. The tasks were determined by incorporating the the steps needed to create a computer program involving low resolution graphics on the Apple IIe into the instructional format. The arrangement of the tasks was determined using the top down approach of computer programming and the requirements of the Apple IIe when using graphics. The steps required to complete each task were identified once the tasks were arranged in order. A complete listing of tasks and steps can be located in Appendix 2.

Target Population Analysis

The target population were fourteen tenth, eleventh and twelfth grade students at Sarah J. Hale High School in Brooklyn, New York. The students were enrolled in Mathematics Computer Instruction 1. referred to here after as MCI 1. At the time of implementation of the project the group was further into the semester and subject matter then was initially planned. The decline in attendance had already begun and the instruction was developed to alleviate the problem from existing in the first place. In order to get students back into the class, the instructor talked with the students with absenteeism problems or parents of the students by calling home or finding the students in their other classes. This caused a sharp rise in attendance as the project was to be implemented. The designer felt the deviation from the original plan was acceptable.

The students in the target population were a very diverse group. They ranged in age from fifteen through nineteen with 86% of the students being seventeen or older. The target population consisted of eleven females and three male students. All the students live in the Fort Green section of Brooklyn with nine students living in New York City Housing projects. The racial breakdown of the group is five students are of Hispanic descent and nine are African American. The majority of the students were seniors and 36% of the students were behind in credits by one year or more. Almost half of the group were repeating the course, and of those students, all had failed as a direct result of their absence from the class. Eleven of the fourteen students surveyed preferred the Liberal Arts classes over the Sciences. The one aspect that the majority of the group agreed upon was their dislike of mathematics with 92.85% stating so in the student survey. The aspect of MCI 1 that the students did like was the use of software while the part they liked the least was writing programs. Their dislike for writing programs was so great that twelve of the fourteen students suggested getting rid of programming as a suggestion in improving the course. This suggestion was taken seriously and the instructor researched the use of educational software in lieu of programming. The instructor had hoped to use an array of computer courseware, ranging from drill and practice to simulation type programs to supplement the material that was being presented to the class. This would have allowed the instructor to assign programs to individual students based on the students need. Permission to do this was denied.

Organizational Constraints

The only constraint the school placed on the project was the amount of time allotted to implementation. Based on Anderson's (1983) media selection process, the designer selected the most appropriate media for this instruction: printed material. Possible constrictions were the lack of computer

accessibility due to malfunction and room availability and the inability to reproduce the materials for the students. The first restriction did not occur since the class is scheduled into a computer lab with nineteen computers and the school has a very good maintenance plan with two backup computers available. The second restriction was avoided by having materials ready well before hand and copying on the math department's copier at off peak times.

Instructional Goal

The instructional goal of this project is, given access to an Apple IIe computer and a pre-created graphed drawing, the student will be able to write a structurally sound BASIC language program using the commands HLIN, VLIN, GR, COLOR to create the design on the graph.

Motivation of the students is a major factor in having them succeed in learning. This is especially true for the "At-Risk" student. The use of graphics is a very good method with which to involve the students and interest them in the subject of computer programming. This is based on the fact of the ease of learning to program the Apple IIe in low resolution graphics. However, it can be incorporated with most of the other BASIC language commands so that it can be used with the majority of the existing course material. In addition to motivating the students, it also adheres to the Conference Board of Mathematics and Science suggestion of giving a visual sense to geometric concepts. The materials created give the student the fundamental usage of the commands, the activities the students are directed to perform give a hands on application to the commands and allows the students to express themselves in an imaginative way. The materials created address the needs of the "At-Risk" student or slower learner. The characteristics that the design of the materials address are that they: 1) give the student a feeling of belonging to the materials; 2) teach using their hands; 3) provide concrete results rather than abstract results; 4) allow for students work to be checked

in many stages; and 5) involve group or social interaction. These characteristics are found in Bernard (1972).

The expected outcomes of the the project are that, after the students have completed the project, they will: 1) want to learn more about the language BASIC; 2) be able to design on paper and write a program to create the design on the computer screen; 3) use the concept of graphics to enhance programs that are assigned later in the course; and 4) attend class on a more regular basis.

Literature, Existing Course, and Material Review

Before beginning the design of instructional material was necessary to determine whether existing materials were available. The instructional material needed to be appropriate for classroom use in a high school. For the purpose of this project, literature was defined as publications providing resource information on the topic. Materials were defined as publications useable in a classroom situation. Sources used to search for the existing literature were the ERIC (Educational Research Information Center) database, The New York City Public Library's database on periodicals, and the Sarah J. Hale High School's Teacher Resource Center.

Related Theory

In determining an instructional goal, the classification of domain of the goal must be determined, (Dick & Carey, 1985). The writing of a computer program requires the learner to perform some unique cognitive activity, thus, is classified as an intellectual skill by Dick and Carey (1985) and Gagne (1985). The four types of intellectual skills are: discrimination, concepts, rules, and problem solving. While writing a computer program, the students need to discriminate between commands to select. The rules that apply to the

language BASIC must be followed and the student must problem solve to arrange the use of the commands in a logical order.

The theory that is being applied is based on Wait and Demana (1987). which states that:

Computer graphics is an excellent vehicle to involve mathematics students with computers. Moreover, it provides students with an efficient tool to solve difficult problems, and to explore mathematical concepts. Writing a computer graphing program gives students the opportunity to apply the programming and mathematics they have studied. (p. 47)

The reasons given to support this statement are: 1) the motivation of the student is increased through the use of graphics; and 2) the students have a visual representation of their work rather than just words or numbers displayed on the screen and thus can see if the results are correct, easily.

Literature Review

Six publications were defined as literature which related to the project. The ERIC database listed thirty-nine publications as a result of the search conducted using the identifiers of computers, low resolution graphics, programming, Apple IIe, mathematics, high school, secondary school.

1. Waits B., Demana F. (1988). An application of programming and mathematics: Writing a computer graphing program. Journal of Computers in Mathematics and Science Teaching, 47-48.

The article describes the benefits of using graphics in programming and how to apply it to problem solving. The article included a sample program which graphs out mathematical equations. The information was used to support the designer's belief in project, but the sample program was given in high resolution graphics and the mathematical concept was far too advanced for the target population.

2. Doheny, C (1984). Compu*Tech basic book 2. New York: Compu*Tech Pub. Co.

The text found in this book is informative and very well presented. The materials give examples and lead the student through exercises. The material is geared for a student on the junior high level so that the examples are not at a very high mathematical level which is appropriate for the target population. The problem with the material is it assumes the student is already familiar with programming and leaves out key elements that would confuse the beginning programmer.

3. Nahrgang, Walivaara, Yarroch (1989). Computer mathematics structured basic with math applications. Ohio: South-Western Publishing Co.

This textbook blends BASIC language programming instruction with relevant, classroom mathematics applications. The text teaches the student how to program using the top-down approach. The material in chapters one and two is very effective in introducing the student to programming. The text does not mention graphics and its advancement of material after the first two chapters is very rapid.

4. Jones, Jr. A.B. (1982). I speak BASIC to my Apple. New Jersey: Hayden Book Company, Inc.

This book is a simplistic approach to computer programming. The book consist of fifteen chapters with numerous practice exercises and clear explanation. The section which is geared towards graphics is geared to a student who has more computer programming experience than the target population.

5. Tebbe , P (1983). Programming the Apple II in BASIC. New Jersey: Prentice-Hall, Inc.

The material in this book is geared to a beginner in computer programming. It is comprised of sixteen chapters in which one is dedicated to graphics. The chapter on graphics is found in chapter fourteen and much is assumed by the author, so that the materials and sample programs are not appropriate for the target population.

6. Elgarten, Posamentier (1984). Using computers programming and problem solving. California: Addison-Wesley Publishing Company.

The Textbook is currently being used in MCI 1. The Materials in the text are geared to instruct on how to use the computer as a tool for problem solving. The text follows the New York City Board of Education's Curriculum Guide for MCI 1 and has excellent examples and activities. However, the author's introduction of the language BASIC is skimpy and the use of graphics is not addressed at all.

Survey of Existing Courses and Materials

Though there were many references to teaching computer programming the major problem with most of the materials was that the topic was introduced as an advanced topic and the authors would present the material geared for a more proficient student then the target population. On the other hand, those materials which were geared to a younger age group, which were presented in a appropriate manner for that age group, would have been insulting to the students in the target population due to text size and terminology. No existing curricula which referred to the topic of graphics were found. The designer determined that two references were appropriate.

1. **New York City Board of Education. (1986). Computer mathematics: An introduction part I.**

This manual is the curriculum guide for MCI 1. Sixty-one lessons with performance objectives and materials are given. The guide does not address the introduction to programming very effectively. The curriculum does not use any form of graphics.

2. **New York City Board of Education. (1986). Computer mathematics: An introduction part II.**

This manual is the curriculum guide for the next course the students currently enrolled in MCI 1 will take. It contains sixty lessons with performance objectives stated and approaches to teach each lesson. The guide concentrates mainly on the mathematical concepts that are to be introduced by the instructor. This doesn't help the instructor with the computer programming segment of the course. The guide does not use include computer graphics in any form.

Plan For Design and Development Effort

Project Plan

The first step of the project, Needs Assessment, began on September 20, 1988. The last step, Summative Evaluation ended on May 16, 1989. The Design Stage ended on December 12, 1988 and the materials were ready for implementation on January 6, 1989. The Project continued with the identification of the test groups on February 7, 1989. The amount of time and effort that the student will have to put into the project will vary, depending on the students final project. The minimum effort that is expected of the students is to be in class, working everyday. In order for the designer to plan effectively, PERT (Program Evaluation and Review Technique) and Gantt

charts were created. A record of actual time versus projected time was kept. In addition to the PERT and Gantt charts, a major events and time line was created. All of the above mentioned items can be found in Appendix 3.

Budget

The Budget for the instructor's program was based on the hourly rate of the instructor, the cost of the materials and the learning tools. The rate of the facilities was estimated by the school's business secretary with the assistance of the school's custodian. The salary of the instructor is $25.00 per hour period. The project should take ten, forty-minute class periods. Grading and evaluation of the students' work was planned for approximately thirty hours. All materials were copied on the school's copier at a cost of .10 per page. Diskette's were bought in bulk of $25 per 100 and overhead transparencies were created at a cost of .10 each. The results are summarized in Table 2.

Summary

A Needs Analysis was performed. As a result, it was made apparent that a means to motivate students was necessary. As a result of the target population analysis and job task analysis, the designer identified the instructional goal as, given access to an Apple IIe computer and a pre-created graphed drawing, the student will be able to write a structurally sound BASIC language program using the commands HLIN, VLIN, GR, COLOR to create the design on the graph. The instructional goal was determined to address the intellectual learning domain of Gagne(1985). The theory which the designer applied is that of Wait and Demana(1987). Five main tasks were identified to support the instructional goal. The media selected were printed and still visuals to support the instruction. Related theory were reviewed to support the project and existing materials and literature was reviewed. A

major events list and time line were developed and maintained in order to meet the projected end date. A budget was estimated for the instructional project.

TABLE 2

Budget for Instructional Program

Labor	Hours	Unit Cost	Total
Analysis	155	25.00	3875.00
Design	20	25.00	500.00
Development	15	25.00	375.00
Implementation	39	25.00	975.00
Evaluation	30	25.00	750.00
TOTAL LABOR			$6475.00
MATERIALS			
Diskettes	(per 100)	25.00	25.00
Copies	(per student)	1.30	32.50
Classroom	(per session)	15.00	120.00
Overhead trans.	(each)	.10	1.00
TOTAL MATERIALS			178.50
GRAND TOTAL			$6653.50

CHAPTER 3

DESIGN

Introduction

Once the analysis of the project was completed the next stage of instructional system design is the design stage. The function of design stage is to specify the abilities the student should possess after completing the instruction. In this section the designer determined what the students had to be able to do to create graphic designs using BASIC on the Apple IIe. The other features of the design stage are the identification of entry-level behaviors, learning objectives, and evaluation methods. The instructional objectives were stated in the form of condition, performance and criteria. The objectives were organized in a logical manner. The objectives were related to steps of instruction.

Instructional Task Analysis

In the analysis stage it was determined that the instructional goal was an intellectual skill. Five main tasks were identified as necessary to master the goal of writing a program using graphics in the language BASIC. The results of the task analysis list the jobs that the student must perform to master the material in the project. For each task the sub-steps needed to accomplish it were defined. The result of these finding is the framework for the instructional design. The instructional task analysis is located in Appendix 2.

Instructional Objective

An objective is a description of a performance the designer wants learners to be able to exhibit before they can be considered competent at the specific task. An objective describes an intended result of instruction rather than the process of instruction (Mager, 1984). Instructional objectives are written directly from the task analysis and at least a one-on-one correspondence between objective and task should be evident.

Each performance objective is broken down into three parts: conditions, performance and criteria. The conditions state what the user will be given or what they will be able use. This may include needed tools, equipment and materials. The performance is something the student must do to show mastery of the objective. The criteria describes how well the student must perform, and states the degree of mastery, i.e., two out of three tries. The terminal performance objective was determined and the five main tasks were identified in the task analysis. Each main task was further broken down into sub-tasks. Performance objectives were written for each task and can be located in Appendix 4. The five learning objectives are :

1. Change the computer from normal text mode to graphics mode.
2. Select a color.
3. Select the correct command based on what is to be drawn.
4. Calculate the x and y coordinate of desired points or lines.
5. Write instructions into BASIC language instructions

Entry Behavior Defined

Entry behavior skills are abilities that enable the student to perform the skills that are to be taught to them (Dick and Carey, 1985). These skills are needed before the learner can attempt to learn a new skill, i.e., it would be ludicrous to try to teach children to add numbers if they could not count. The

designer identified five entry behaviors necessary for preparing a graphic computer program. The student must be able to:

1. Turn on the Apple IIe
2. Discriminate between a point and a line
3. Discriminate between horizontal and vertical lines
4. Define Coordinates
5. Discriminate between immediate and programming computer modes

Group and Sequence Objectives

The instructional objectives correspond to the job task and their sub-tasks. The main task and the sub-task were written in the design stage, they were placed in a logical order of writing a BASIC program to produce a graphic image. The material will be presented to the students in three instructor-led class periods of forty minutes. Students will work on projects to reinforce the material presented to them for seven forty-minute periods. The grouping and sequencing of the objectives are found in Table 3.

Learning Activities Specification

The time period planned to implement the project was ten, forty-minute periods. In this period of time all required projects were completed and the lessons were presented using the introduction, feedback, summary approach. Gagne (1985) identifies nine internal processes that occur during learning. The external support for the internal process are the instructional events. The nine instructional events compose a complete lesson plan. Table 4 compares the internal process, instructional events and the lesson plan.

Table 3

Group and Sequence Objectives

Lesson #	Objective
Lesson 1	1 a
	1 b
	2 a
	3 a
	4 a
	4 b
	4 c
Lesson 2	3 a
	3 b
	3 c
	5 a
Lesson 3	5 b
	5 c
	5 d
	5 e

The learning activities are instructor-led or self-paced assigned projects. The lesson plans are written in a developmental format. Table 5 summarizes Gagne's internal processes including method and media with the structure of the project.

A instructional strategy was designed for the information presentation and student participation. These components are considered the exchange or interface point. The presentation has two parts, the information and examples. The student participation section has two areas, sample practice items and planned feedback strategy (Dick and Carey, 1985). The instructional strategy is conducted for each task identified. The complete instructional strategy can be found in Appendix 5.

Table 4

Internal Processes, Instructional Events and the Lesson Plan

Internal Process	Instructional Events	Lesson Plan
	Introduction	
1. Reception	Gain Attention	Stimulate/Gain attention
2. Expectancy	Inform learner of objectives	Tell learner what they will be able to do
3. Retrieval to working memory	Stimulate recall of prior learning	Review previously learned materials
	Development	
4. Selective Perception	Present Stimulus	Present the contents to be learned
5. Semantic Encoding	Provide learning guidance	Give examples of the activity
6. Responding	Elicit performance	Have students do applications dealing with the activity
7. Reinforcement	Provide feedback	Give informative feedback
	Summary	
8. Retrieval and Reinforcement	Assess performance	Have students apply concepts
9. Retrieval and Generalization	Enhance retention and transfer	Evaluate and provide review

Table 5

Relationship of Method and Media to Internal Process

Internal Process	Method	Media
1. Reception	Computer demonstration	Computer software
2. Expectancy	Computer demonstration/ Lecture	Computer software/ printed material
3. Retrieval to working memory	Lecture	Printed material/ overhead projector
4. Selective Perception	Lecture	Printed material/ overhead projector
5. Semantic Encoding	Lecture Examples	Printed material/ overhead projector
6. Responding	Self-paced projects	Printed materials
7. Reinforcement and informative feedback	One-on-one	Printed materials
8. Retrieval and Reinforcement	Self-check Display work	Printed materials/ computer display
9. Retrieval and Generalization	Post-Test Individual projects	Printed materials/ computer programs

The materials created in this project were designed to support the instructor led presentation. Printed material and still visual were determined to be the best media. The materials created were designed to support and reinforce the instructor's presentation. The instructor will use overhead transparencies and each student will be given a handout of the transparencies. The activities the students would be required to perform allow for student-teacher interaction at four points.

The use of still visuals met four objectives. They: 1) teach recognition of unfamiliar objectives; 2) teach discrimination skills; 3) reinforce the words of the instructor; and 4) clarify and reinforce that which the instructor is presenting. The use of printed material: 1) provides direction; 2) provides factual information to describe work functions; 3) provides a real life situation...actual application of the command (Anderson, 1985).

Still visual and printed materials are used with printed material being the primary media. The still visuals are overhead transparencies of the printed materials the students will receive. The advantages of using printed materials are suggested by Anderson (1985).

1. Students can stop at any time.
2. Students can proceed at their own pace.
3. Student and teacher can easily review materials.
4. Materials a very portable, the student can study and use materials when they choose.
5. The lesson materials can be resequenced easily.
6. Materials can be produced economically.

There are disadvantages in using printed materials, however, the designer tried to work around the disadvantages. The disadvantages stated by Anderson are:

1. Length of printing time -- This was overcome by having materials ready well beforehand and using the schools copier.

2. Extensive Printing can turn off and bore students -- Lessons always had students hands-on activities which keep them from becoming passive learners.

3. Unless given care, the materials can be damaged -- All handouts had holes punched so that they may be stored in notebooks. All of the students

work was stored on the computer diskette which was collected by the instructor at the end of each forty-minute block of instruction.

The materials were designed with consideration of the target population. The style and vocabulary were at a level that fit the target population. Instructions were clearly stated and the instruction allowed for numerous student-teacher interactions, the use of positive reinforcement and remediation was included in the instruction.

Assessment System Specification

The students will be assessed in three forms during the project. The materials include a performance checklist, evaluation of projects completed and a post test. A pretest was deemed to be unnecessary, it was determined that none of the students in the target population had any knowledge of computer graphics.

Performance Checklist

The performance checklist will be performed by the instructor by observing each student individually. The purpose of the checklist is to determine which students need individual or small group remediation. The checklist will be used as the students are working on assigned projects. The developmental version of the performance checklist can be found in Appendix 7.

Project Completion

In order for a student to complete an assigned project, they must demonstrate a proficiency in the material covered in the lessons. The evaluation of the students projects will be used to determine how well the students can apply the objectives. An advantage of this form of evaluation is that it allows for student-teacher interaction at five points.

Post Test

The post test will be given at the end of the block of instruction. The test will be used to determine whether the students have mastered the objectives. The developmental version of the post test can be located in Appendix 7.

Evaluation System Specification

The evaluation process used in this project entails two parts, formative and summative evaluation.

Formative Evaluation

The formative evaluation is conducted during the development of instruction to test the effectiveness of the instruction, and shows the designer where improvement of instruction or evaluation is needed (Dick & Carey, 1985). The formative evaluation is defined in three phases: one-on-one, small group, and field trial (Gagne, 1985).

While conducting the formative evaluation the designer collected all pertinent information in the one-on-one, small group and field trial group. The data well be collected from the performance checklist, project observation, post test, and attitudinal questionnaire.

Summative Evaluation

Summative evaluation is used to determine if the instruction is effective. It answers the question "has this instruction made a difference in student learning - a difference that accomplishes a worth while purpose" (Gagne, 1985). The summative evaluation is conducted after the instruction is presented and normally does not effect the instruction during the initial implementation. The evaluation method uses Kirkpatrick's four levels of evaluation: reaction, learning, behavior, and result/impact (Kirkpatrick, 1987).

Learning Transfer System Specification

The system to be used to see if the learning is carried further in the semester will have to be via observation of the students. The signs the instructor would be looking for is a willingness on the part of the student to write programs. The instructor would also want the students to incorporate graphics into other programs assigned during the term. A review of attendance records would also be a means of showing success or failure of the project.

Summary

The instructional task analysis was completed. The terminal performance objective was identified and performance objectives were determined for each learning activity using the condition, performance, criteria format. The minimal entry requirements were identified. Gagne's nine instructional goals were related to the lesson plan and to the learning activities. The forms of assessment to be used were designed and the two forms of evaluation to be used, formative and summative, were discussed.

CHAPTER 4

DEVELOPMENT

Introduction

In the design stage of the project the developer specified the performance objectives. From the objectives, training and evaluation materials were developed, reviewed and evaluated. The results of those steps are the materials to be used by the target population. This section describes how the materials were developed and reviewed.

Learning Activity Development Scheme

The designer's main concern in the development of the materials and lesson was that the learners were not passive for long periods of time. The lessons were not meant to be overbearing or boring. The material was to be presented with many chances for the students to do hands-on learning. An instruction strategy for each objective was performed, see Appendix 5. From this step the materiels needed were produced. A computer program to demonstrate the ability of low resolution graphics and to motivate the students was written. A developmental lesson plan was developed as required in all lesson taught at Sarah J. Hale High School. The required lesson plan format is in Sarah J. Hale's Policy Manual, see Appendix 8. Handouts and overhead transparencies were created to support the lesson and to provide easy reference materials for the learners. The lessons and materials were created using Gagne's nine internal processes as a reference. Each lesson tried to incorporate as many of the learners internal processes to facilitate learning.

As each section of the materials were produced they were concept tested with three other faculty members. Two were math teachers with

computer programming knowledge. The two teachers had eight and four years teaching experience respectively. The other faculty member was a social studies teacher with no computer knowledge and fifteen years teaching experience. The designer would confer with the teachers before continuing with the development of new materials. The teachers were shown all of the materials to be used in the project. The designer received positive comments about the materials. All of the faculty members found the materials to be of high standards in appearance and in content and felt the materials would help provide clear instruction.

Learning Activity Development

Printed materials, still visuals, and a computer program were the media used in the project to teach BASIC programming using graphics. The entire project, presented by instructional event follows.

1. Gain attention--A computer program which demonstrated computer graphics was developed. This showed the student what they could create and ignited their attention towards computer programming as well as giving them a sample of what they would be able to accomplish at the end of the instruction.

2. Inform learners of objectives--The computer demonstration would give a brief example of what would have to be done and the student was presented with a handout that stated the objective of the course. The students were informed that they would be writing programs that would create computer graphic designs.

3. Stimulate recall of prior learning--The student is not expected to have prior knowledge of the use of computers, but a class discussion on the differences between points and lines and horizontal and vertical would be conducted so that the student will review the entry behaviors.

4. Present stimuli--The instructor led a lecture on the information being presented and use the overhead transparences to highlight the information. The students will then try exercises on the computer to reinforce the material introduced. After the students have completed the exercises, they will be given the handouts that reinforce the lesson.

5. Provide learning guidance--The instructor went over the exercises that the students perform and provided feedback and remediation.

6. Elicit performance--The projects the students will perform will demonstrate to the students that they can transfer the concepts into practicality.

7. Provide feedback--The instructor used a performance checklist as the students are working on the projects. The checklist will help the instructor determine where the individual student is having difficulty and where the entire group needs assistance. From the checklist the instructor can make necessary changes to help the individual student or the group as a whole.

8. Assess performance--The students were assigned five projects to complete during the duration of the project. After each project the instructor will evaluate the work of the student. Students programs will be printed and displayed on the bulletin board to provide recognition and give the student a feeling of accomplishment.

9. Enhance retention--A post test was used to measure the students knowledge of the objectives. Retention was further enforced by having students continue using graphics in programs assigned after the project is completed.

The designer allowed five weeks for the development of the instructional materials. Due to the efficiency of the teachers who helped with the concept testing, the actual time for the development was three weeks. All

of the materials developed can be found in Appendix 6, with the exception of the computer diskette and overhead transparencies which can be located, see Appendix 11.

Learning Activity Review

The completed materials were reviewed by the subject matter expert (SME), Hersey Dryfuss, Computer Coordinator at Sarah J. Hale High School. The materials were reviewed for appropriate vocabulary, grammar, and correct spelling by Catherine Albergo, English teacher at Sarah J. Hale High School. In addition, the designer checked the materiels to determine whether they met the needs of the project. The materials, with a few minor adjustments, were deemed sound in content and structure and were prepared for implementation.

Materials for Evaluation Produced

Twenty-three sets of copies of the materials were produced. This amount was needed to provide copies of each handout to the students in the one-on-one, small group and field trial evaluation. The materials used in the summative evaluation were the performance checklist, post test and attitude questionnaire. All of these materials can be found in Appendix 7.

Summary

The learning materials and lesson plans were developed based upon the top-down approach to computer programming and Gagne's nine instructional events. The materials created help reinforce the instruction of writing BASIC programs using graphics and are addressed to students with no knowledge of computer programming. The materiels include a listing of the objectives and an individual sheet for each concept. The evaluation materials that were

created are the performance checklist, post test and attitude questionnaire. All of the materials were reviewed by the SME and deemed acceptable after minor revision. The materials were prepared for distribution to the students involved in the formative evaluation of the project.

CHAPTER 5

IMPLEMENTATION

Introduction

The overview of the implementation phase of the project is as follows: the material presented to the class was: 1. a collection of handouts; 2. computer demonstration and overhead transparencies interacting with lecture and student trial and exploration; 3. the instructional delivery included a computer demonstration on the student's individual computer; - this demonstration allowed the student to see an example of what they will be able to do and how it is done; 4. the students were actively involved in each phase of the delivery since they tried the new commands as they are presented to them and then as a group determine the function of each command. The students were evaluated in three ways. One of these was a performance checklist which the instructor used to evaluate the students as they worked on projects. The second method was the completion and evaluation of the students projects, which were creations of their own design for which they wrote the program to produce the design. These projects were evaluated on the basis that the program ran error free, the design met the criteria set forth in the project and that the planned design matched the program's output. Last, but not least, was a written exam.

Materials for Implementation Reproduced

All materials created in this project were created to enhance the learning of Low Resolution Graphics on the Apple IIe Computer. The materials were created with the understanding that the student has an Apple IIe computer with a color monitor and, at least one disk drive. Low

resolution graphics mode turns the screen into a grid forty columns across and forty rows down, with sixteen color options and three lines of text at the bottom of screen.

The materials developed for the implementation of the project are a computer graphic demonstration, graphs, overhead transparencies, lectures and student assignment sheets. All of the materials mentioned can be found in Appendix 6 in the order they are described below, except the overhead transparencies which were provided to the office of the Master of Science in Training and Learning Technology at New York Institute of Technology, Old Westbury NY.

The computer graphic demonstration showed a multi-colored low resolution display which incorporated many easy steps, thus creating a complex graphic. The purpose of this program is to motivate the students to want to learn this topic. The students will be able to run the program and see how each section of the graphic was created. The students will also see the amount of work needed to create the program. The program will also run through the graphic one section at a time and will demonstrate the ease of doing each section. Though the student will run the program at a self-paced rate, the average time to view the program was twenty minutes.

The Graph sheets that were distributed to the students will be important in each phase of the actual graphing out of the program. The graphs are designed to give the student a picture of what the apple graphic screen is really like. The students used the graph to picture the the "x" and "y" coordinate points and to plan where points should appear on the screen. The graph also help with the lecture, because students were able to have a true image in front of them when discussing the commands. This is helpful since the only other way, was for the student to imagine where points will appear on the monitor. The student used the graph to plan out the design for

which they wrote the program to create. The students had access to as many graph sheets as they needed.

Overhead transparencies were used to enhance the lecture, thus, the only interaction the student will have with the overhead is to view and take notes or ask questions using the graph as a reference. The overheads demonstrated to the students the difference between graph mode and text mode. It also explained how to switch from one screen to another. The overhead also showed the sixteen colors to choose from and how to select a color. The number of transparencies to be created totals six, each being one page in length.

The class lecture was to be slightly different from the usual lecture where students listen while the teacher talks. Instead, the students were working on the computers as the instructor lectures. The students heard about what a specific command would do, then they were given an example to try. After they had successfully followed instructions, they were asked to try the same command using different coordinates and try to predict the output on the screen using the aforementioned graphs. The lectures that were presented explained the facts and the student, through experimentation, had to determine how the commands really work, thus encoding the material using two methods, cognitive and psychomotor learning. The information that was presented to the students was as follows:

1) Type in the command GR. What happens?

It is expected that the students will give a variety of answers ranging from "Nothing," to "I can only now type at the bottom of the screen." The purpose of having the student do this is to show them that they will use the GR command to switch the monitor from Normal TEXT mode to GRAPHIC mode.

2) Type the Command TEXT: HOME. What happens?

The students answers ranged from "Nothing," to "The cursor is at the top of the screen again." The purpose of this question is to show that the TEXT:HOME command will change the screen from GRAPHIC mode to TEXT mode.

3) Type the Command COLOR = 7. What happens ? What do you think happened ?

The students will see no change but it is expected that the students will determine that a color was selected with which to draw. The discussion will be guided towards defining what "seven" means and the color chart on the transparency will be displayed so that the students will then be able to see what each number represents. It will also be noted that while the COLOR = # command is used to select a color, it does not draw.

4) The next part of the lecture will be directed towards expressing the difference between a point and a line in low resolution graphics. The students will use the graphs to picture the differences between the two. The discussion will then turn towards the difference between horizontal and vertical lines.

5) The students will be asked to use the graph to see the differences between the x and y axis. The students will be asked to determine the limits of the screen as being from zero to thirty-nine. The students will be informed that the X value represents the horizontal value and the y value represents the vertical value.

6) To get a visual idea of what the command does the students will be asked to use the computer and try the PLOT x,y Command. Before they enter the command, they will be asked where on the screen the point should appear. The students will then try to predict why their selection of placement was right or wrong. The students will now incorporate the selection of colors and the plot command and try different points.

7) The same method will be used to show how the HLIN x1,x2 at y and VLIN y1,y2 at x work.

8) After this point the students will be working on projects and will receive individual attention.

The assignments that the students will perform will, at first, involve trying to reproduce the original graphic that was presented to them. The students will do this one step at a time, reinforcing a new topic such as switching from drawing one point at a time to using the HLIN and VLIN command to draw horizontal and vertical lines, respectively. Once finished with each section, they will have reproduced the first example. The students will then produce their own design and proceed to write the program that creates their own design.

Instructional Delivery

Day 1

The students will begin the instruction by running a graphic program which is designed to show them what they will be able to do at the end of this instruction. The program is designed so that it breaks the parts of the program down into its smaller parts. Each student will be able to go through the program at their own pace. After the students have observed the demonstration, they should be motivated to attempt to create their own graphics.

They will then be told to try the GR command and see what happens. The students will then see, with the help of the overhead transparencies, what happens when the GR command is entered. With the use of the same materials, the student will also learn the function of the TEXT : HOME command. They will then be asked to switch from one mode to another in order to gain familiarity with the commands function.

The discussion then turns to the means by which they select a color with which to draw. The students will be given an example which consists of the command COLOR = (a number from 0 to 15). The color chart will then be displayed on the overhead so that the students will know what the numbers represent. It will be pointed out to the students that the COLOR = # command only selects a color; it does not draw anything on the screen, much like buying paint doesn't mean the room is painted. The students will be asked to type the command and use different numbers to become familiar with the syntax of the command.

Day 2

The students will be given the graphs of the graphic screen. Using these sheets, and a large screen monitor to illustrate, the students will visualize the concepts of points, horizontal and vertical, lines and the x and y axis. They will be asked to label their graphs as the instructor points out the facts. Through the use of the large screen monitor, the instructor will be able to demonstrate what they are doing on their graphs.

The students will then be given the PLOT x,y command and will be asked to enter the command into the computer. Before executing the command, they will be asked to predict where they believe the point will show up on the screen. They will be able to use the graph to assist with their prediction. The students will then explain why their prediction was right or wrong. They will then have to put points in each corner of the screen and change the color of each point in order that they can apply what had been discussed during the lesson.

Day 3

The beginning of the third day will have the students using the plot command in conjunction with all the previously learned materials, thus reinforcing the material already covered. They will be asked to draw a line

across the top of the screen. The class will discuss that while they could plot all forty points, a line going from left to right is called a horizontal line, and that the command HLIN 0,39 at 1 could do the same as forty PLOT x,y commands. The same will be done to introduce the VLIN command. The students will then be asked to make a border around the screen in which each line is a different color. When they have finished, they will be able to experiment on their own.

After this lesson all the information will have been introduced to the students. For the next three to five classes, the students will practice and reinforce their graphic programming skills while working on projects. During this time, the instructor will assist students individually or in small groups. The students will be able to work together and help each other through the projects.

The group size will vary depending upon the accessibility of the computer. There should be no more than a 2:1 student-computer ratio with a 1:1 ratio being optimum. For this testing situation the group consisted of fourteen students.

Data Collection

The instruments that will be used to collect data from the students will be as follows:

1) Performance Checklist
2) Test of cognitive knowledge
3) Evaluation of projects
4) Questionnaires
5) Collection of attendance records

Copies of the materials used for data collection can be found in Appendix 7.

The performance checklist will be administered by the instructor to evaluate the students as they are working on the assigned projects. The checklist will be used to help the instructor determine which students need small group or individual remediation and which may be able to enhance the design. The use of the checklist will not begin until after the student has completed the first phase of the project. The checklist will account for one-fourth of the students' unit grade.

The post test will be given at the end of the unit. It would not be logical to give the group a pretest since it has been determined in the entry behavior that none of the students have had this topic presented to them. The test will be used to determine which objectives the students have learned. The test will account for one half of the students unit grade.

The evaluation of the students' work was used to determine how well the students could apply the objectives that where taught. This evaluation accounted for one-fourth of the students unit grade. The questionnaire was used to determine how the students felt about this unit.

The collection of the attendance data was used to give the unit credibility with the administration. If the data shows that a drop in cutting/absenteeism takes place, it will serve to influence the administration.

The performance checklist tests the objectives that the student is expected to master. The checklist stated which objectives the instructor feels the student has mastered. The data was to be broken down in a table that states the mean of the group for each objective, the mean per student and the overall mean of the group. This information allowed for the designer to determine where the instruction or materials needed to be revised.

The post test results was broken into an item analysis to determine the validity of the test.

The evaluation of the students' projects was presented in a frequency

table to determine how many students have successfully completed each project. This information helped the designer determine whether the amount of work assigned and the time allotted was sufficient.

The questionnaire's responses were presented using a frequency chart reporting the numbers of responses for each question and general summaries of the students' responses to the questions. This information was used to formulate the summative results dealing with the students' reaction to the project.

The attendance records show the comparison of a ten-day period before the instruction started and the ten-day period starting with the first day of instruction. The information will state the the number of absences per student broken down into two categories: legal absences and cuts.

Summary

This chapter gives the "who," "what," "where" and "when" of instruction and evaluation to be undertaken in this Apple IIe low resolution graphic project. The first section of the chapter, materials for implementations, describes the materials that where developed or planned to be used to aid the students in learning Apple IIe low resolution graphics. In the instructional delivery section of this chapter, the planned instruction on how the materials are intended to be used is discussed. The method of evaluation was also discussed in the data collection section of this chapter. The data collection section gave a detailed description of the testing materials and explained how the data produced from the testing materials is to be used.

CHAPTER 6

EVALUATION

Introduction

The evaluation of the low resolution graphics teaching module on the Apple IIe computer was broken down into three sections, one-on-one, small group and field trials. Each group went through the same instruction in the same manner. After each test group, modifications to the materials or instruction were made and will be noted in the subsequent materials. The summative evaluation attempts to tie all the data together and show whether the module was worth doing. The designer used four levels of evaluation to complete the summative evaluation; reaction, learning, behavior and results.

Formative Evaluation

Formative evaluation is performed to determine if revisions must be made in the instructional or evaluative materials. The formative evaluation is comprised of three test groups, one-on-one, small group, and field trial. Following is an outline of the results of each section with a detailed explanation of each section to follow.

One-on-One

A general overview of the results of the One-on-One group is as follows: 1) The Demonstration program needed to be changed; 2) The originally planned pace of instruction was too slow; 3) There was an error in one of the assigned projects; 4) Questions 3, 11.1 and 11.2 might identify a problem in instruction and/or questioning, but more data is needed; 5) The students responded favorably to the questionnaire stating that overall they liked the instruction.

The one-on-one evaluation took place with three students after school for six forty-minute sessions. The three students each possess the prerequisite skills and desire to learn as much about computers as possible.

Student A is an nineteen-year-old male, who will be graduating in June. He has a strong interest in computers and plans to major in computer science in college. The student did not know how to program graphics with an Apple computer, but has previously worked with sprites on the Commodore 128. The student had already taken and passed the course for which this project is created.

Student B is an eighteen-year female, who will also be graduating in June. The student's mathematical ability far exceeds the level which the course requires. The student is enrolled in a MCI course and is doing extremely well without even trying. She does show some flaws in her programming ability.

Student C is a seventeen-year-old male. He is a junior. The student has a strong interest in the computer field. He has a slight speech impediment which makes him very shy. Student C has prior programming experience with the Amiga computer, but no experience with the Apple computer. He was quickly able to adapt to a different keyboard and operating system.

The method used to present the instruction to the one-on-one group deviated from the planned implementation of the material. A change made by the instructor in this group was that handouts were used instead of overheads transparencies.

In evaluating the students with the performance checklist, the instructor used immediate reinforcement and remediation instead of working through the entire checklist then giving reinforcement. This caused results which showed prerequisite objectives were failed while later objectives were mastered. The questionnaire was given in an interview format. This did not

seem to bother the students to any great extent since students A and B were not known for being shy when it came to expressing themselves. Student C preferred to answer the questionnaire on his own, since he preferred written communications to oral communications. The tables mentioned below can be found in Appendix 9. The outcomes from the one-on-one trial are as follows:

1. The motivation program was too complicated and had the opposite effect than intended. All three students expressed on the questionnaire a feeling that the motivation demonstration showed how much work was involved, and many people would be turned off or overwhelmed. It took each student on the average twenty minutes to work through the demonstration and the students felt that it became dull after five minutes switching from lines of code to color pictures. Student B stated that she just pressed return to get through the demonstration after the first three sections ju to get it done. Because of this feeling a change in the motivation program was made. When the students were shown the revised version of the demonstration the students expressed that the new demonstration did what it was trying to accomplish and was not boring, even though it was not very fancy.

2. The pace of the instruction was too slow. The students complained about the number of examples being too great. Student A felt as though he was being held back with the examples. All three students felt that the material could have been covered in one session. Taking into account the individual attention and the ability level of the students, the designer arranged the instruction into two lessons instead of three.

3. A mistake was found in the handout for project 1.2; the plotting of the assigned points will create a distorted final project 1. Corrections to the assignment have been made and tested to insure that the corrections are not also incorrect.

4. The three students overall did well on all levels of evaluation as can be seen in the tables found in Appendix 9. The students responded favorably on the attitude questionnaire, which asked for a general impression of the material, the students enjoyed learning about graphics and felt they had learned something new. Student B and C have both come to work on graphics projects during their lunch-time and after-school.

5. The item analysis of the post test showed potential problems with items 3, 11.1 and 11.2. The analysis made the designer conscious to the problem and he carefully monitored those questions in the small group, but the number of sample students was determined to be too low for the question to be changed or deleted.

6. The students had difficulty finishing all of the assigned projects in the prescribed time. The students in many instances would stay longer to complete a program they were working on.

Small Group

The general outcomes working with this group are as follows: 1) The students had a mean of 79.32% on the performance checklist; 2) The post test scores mean was 82.55%; 3) Question three on the post test is a poor question and items 11.1 and 11.2 are still giving students problems; 4) Attendance was up compared to an equivalent time period before the instruction was presented; 5) The students responded favorably to the questionnaire in areas dealing with motivation and interest.

The small group trial took place with six students for eight forty-minute sessions. The six students were all enrolled in an after-school computer literacy program for bilingual students. All six students spoke French-Creole as their primary language, but had a sufficient command of English. All six students have come to the United States in the past two years. Throughout the year they have learned many computer applications, but possess no

programming ability. This group was not the primary test group, but the original test group was cancelled before instruction could take place. The six expressed an interest in learning and most possessed a very high level of mathematical ability.

Student A is a sixteen-year-old female, who has been in the country for fourteen months. Her math scores show her to be well above the prerequisite math level needed for the project. Her ability to speak English was poor. She is a sophomore.

Student B is an eighteen-year-old male, who has been in the country for two years. He is senior who will be graduating in June. He is currently enrolled in a pre-calculus math class, therefore he has the prerequisite math skills needed in this project, but has no knowledge of BASIC programming. Student B expressed a desire to learn more about computers but his program has not allowed for him to take any of the computer classes offered.

Student C is a sixteen-year-old female, who has been in the country for sixteen months. She is a junior and very active in school activities. Her math and English scores are average and the student has already taken and passed the course for which this instruction was intended. She has limited programming skills.

Student D is a fourteen-year-old female, who has been in the country for nine months. Her math and English scores are considerably lower than the other members in the test group. She is currently enrolled in a bilingual fundamental math class. At first the instructor was not going to select her to participate in the test group, but her persistence and good nature won the instructor over. She has no programming skills.

Student E is a seventeen-year-old male, who has been in the country for eight months. He is a sophomore until his school records catch up with him. In eight months he has attended three different high schools and has been

suspended and transferred out of two of the schools. His math level exceeds the prerequisite and his English is very good, however he has no prior programming skills.

Student F is a nineteen-year-old female, who has been in the country for two years. She is a senior and hopes to graduate in June, but probably will graduate after summer school or in January. Her math score on standardized test and RCT's indicate a person with a fair math ability, but her grades show otherwise. Her biggest problem is attendance or lack of it. She is generally a nice person with a rather sharp temper. She has the ability to do far better than she does, but is unwilling to work any harder than she needs. She also has no programming knowledge.

The only changes in the instruction from the plan were those mentioned in the one-on-one section. They included: 1) a simplified demonstration; 2) fewer examples; and 3) only two days of instruction instead of three. Immediate feedback was used while administrating the performance checklist.

The tables mentioned below can be found in Appendix 9. The outcomes from the small group trial are as follows:

1. The performance checklist, Table S1, shows the mean of objectives mastered by the students to be 78.2%. This is a large drop from the one-on-one group whose mean was 92.3%. This can be attributed to two factors. 1) One student in the group mastered only 30.77% of the objectives. If the one student who scored low was not in the test group, the group average would have been 87.7% which is much closer to the results achieved in the small group. 2) The students where still apprehensive of the computer at the time of the performance checklist, as a result of now giving the commands to the computer versus using application software.

The items that seemed to cause the most problems were: objective 1, types the command GR asked to switch screen from text to graphic mode; objective 2, type the Text:Home command when asked to switch from graphic to text mode; objective 6, label the x and y axis; and objective 7 which is, state the X value of a point on the graph.

2. The results of the post test showed a mean of 82.5% and that items 3, 11.1 and 11.2 caused the greatest problem for the students in the test in Table S3. Question 3 is a poor question which does not test the objective. The question asks about the order of entering commands when the objective calls for the student to be able to state or type the command when it is needed. A better question would be: HOW DO YOU SWITCH DRAWING IN MAGENTA TO LIGHT BLUE?

Items 11.1 and 11.2 are written responses, four of the six students did not answer the questions and the two that did answer question 11.2 answered incorrectly.

In a follow-up interview with the students, they stated that they did not know how to word what they had done but could do it, which is evident since five of the six students answered question 11.3 correct which is the writing of the program.

3. The time allotted to the students to complete the projects was sufficient since all the students completed all five parts of the projects. It must be noted that students would not have finished projects if they did not plot points out at home before trying it on the computer.

4. The students enjoyed the material overall as indicated in item E1 of the attitudinal questionnaire. A surprising fact on the questionnaire was that no student filled out any comments on it either good or bad. This occurred even after informing them that their identity would not be known. Overall, on the survey the students basically liked everything with no complaints.

5. The attendance for this group was different from a normal classes. Attendance was not mandatory. The six students were in class all eight sessions the project was implemented, which for two of the students was a marked improvement. This can not be attributed only to the presentation, though it was a factor. The other two reasons were: 1) A minimum amount of time is required in the class to receive a credit; and 2) Two students know the instructor was counting on them to be there and liked helping the instructor.
6. Overall the students did very well even with serious deficiencies in the prerequisite skills. The major disappointment was their lack of comments on the questionnaire.

Field Test

The general outcomes of their instruction and evaluation are as follows: 1) The students mean for the performance checklist was 81.87%; 2) The post test mean score was 80.35%; 3) A decrease in absenteeism and cutting was seen; 4) The students mean answer in the attitudinal questionnaire was a four which represents an agree or general liking of the material covered.

The field group instruction and evaluation took place with fourteen students for fifteen forty-minute sessions. The course title for which this instruction was designed to be used is MCI and the test group was one section that was currently enrolled in the course. The students generally have average to below average mathematical ability according to standardized test results. The students in the past dreaded writing programs to calculate various formulas. The minimum prerequisite skills were present in all students.

Student A is a seventeen-year-old female, She is a junior with very poor math abilities. On her most recent attempt at passing the Regent Competency Test (RCT), she scored a 45%, which is her best of four attempts.

The student tries but has a serious attendance problem and is usually late to class when she does attend.

Student B is a sixteen-year-old male. He is a sophomore whose standardized test scores show he should be doing far better then he has performed in the class as of yet. The student's major problem is his attendance which makes him miss exams and quizzes. He enjoys writing programs, unlike most of the other students in the class. He possesses the prerequisite skills.

Student C is an eighteen-year-old female. She is a senior and will be graduating in June. The student has the prerequisites and is presently repeating the course because she had failed it previously. The student's major problem last term was her attendance due to not having a baby-sitter for here ten-month-old daughter. Since then she has gotten her child into the schools child-care program. Her attendance has improved but she is often late.

Student D is a nineteen-year-old female. She is graduating in June and is taking this class after failing a higher level math class three times. She is a quiet person who doesn't ask questions when she needs help, but she will get her work done. Her mathematical abilities are slightly above those needed in the class and she possesses the prerequisite skills.

Student E is a seventeen-year-old female. She is a junior and is active in school government. She is very personable and well liked, yet she is very negative towards the instructor and is distracting at times, due to the fact that she was not happy with her first marking period grade even after the instructor reviewed the grading policies and her work. Due to this problem she is often absent from class. Her math abilities are below average as she has taken the RCT and failed it with a score of 60% four times. She possesses the prerequisite skills.

Student F is a nineteen-year-old female. She is a senior who is graduating in June. She was told by her counselor that she does not have to pass the course to graduate, thus she attends class and tries to do nothing. She has an average math ability and possesses the prerequisite skills.

Student G is a sixteen-year-old male. He is a junior and member of the schools baseball team. There are many days he will come to class and want to talk only about the previous day's game instead of doing any school work. The student has a slightly above average math ability and is a very strong programmer. He possesses the prerequisite skills.

Student H is a nineteen-year-old female. She is a junior who is in the special education program. The student has many family problems compounded by her sight and speech abnormalities. The student is very self-conscious and quiet. She demands much of her instructor's attention when working on programming or math problems. The students mathematical abilities are well above average, but she was placed in the course due to the fact she does not respond very well to failure. She possesses the prerequisite skills.

Student I is an eighteen-year-old female. She is a senior who has recently moved from Los Angeles to New York City. She has been accepted to USC with no idea of what she wants as a major. Her math abilities are above average and in California she was enrolled in a pre-calculus course. She was given the course to fill her schedule. Her only problem is she has computer phobia and does not do well with anything that deals with computers. She has a habit of second guessing herself when it comes to writing programs and mixing the logic of the program thus causing a mess. She possesses the prerequisite skills.

Student J is an eighteen-year-old male, he is a junior. In the first two marking periods he was in class fourteen times out of forty-seven classes,

though he was never absent from school. He is repeating the course due to his lack of attendance in the previous term. The student completed none of the homework assignments given to the class and has been absent for all but one of the ten weekly exams. The student possesses the skills needed.

Student K is a seventeen-year-old male. He is a junior with many responsibilities outside of school. He works six hours every day after school then goes home to watch his two younger brothers while his mother goes to work. He also gets them ready for school and brings them to school, because of this, he is often late or absent for early classes. He is a very responsible person who will go out of his way to get work he has missed due to his lateness or absences. His math skills are average and he has the necessary skills.

Student L is a nineteen-year-old female. She is a senior who will not be graduating in June. She had a baby boy in December and often does not get up for school on time. Due to scheduling problems this course is the only class available to her. She has very poor mathematical abilities and does not possesses the prerequisite skills needed in this project.

Student M is a seventeen-year-old male. He is a senior who recently become a very serious student. The student has a part-time job in Wall Street and has seen how important an education is to him. He has average math abilities and possesses the skills needed for this project.

Student N is an eighteen-year-old female. She is a senior who will be graduating in June. She has average math ability, yet she seems unsure of her ability when working on the computer. This condition exists even when using application or CAI software. She possesses the skills needed.

The only change from the original plan other than those mentioned in the one-on-one and small group section was the extension of time. It was determined that more time was needed for the students to complete the

project. Permission to extend the length of the project was granted by the Assistant Principal of Mathematics at Sarah J. Hale High School.

The tables mentioned below can be found in Appendix 9. The outcomes from the field trial are as follows:

1. Generally speaking from the results of the attitude questionnaire, the students where happy with the material. The two students who were not happy with the demonstration program wanted it to be more complicated; when they were shown the original demonstration program they agreed that the design was better but the demonstration was too long and the one they used was better. Another student who was not happy with the demonstration wanted it to be easier; the same student also felt not enough time was given. In collecting the data from the students, the designer realized that nothing was known about the person who was answering the questionnaire. Data about the participant should have been asked for on the questionnaire so that the validity of the information could be maintained. Questions such as the range for which they scored on the test and how many of the projects they complete should have been asked to insure that someone who did poorly didn't respond negatively because of sour grapes and someone who did well does not only praise the material.

2. The results of the performance checklist shows the overall mean for the checklist to be 81.87%. This is compatible to the 79% achieved in the small group. One student was considerably off the mean at 23.08% which lowers the mean considerably. Had the one student not been in the test group the mean would have been 86.8%. The Objectives that present the most problems are objectives two and six which also were the problem objectives in the small group testing. The reason for this may be that neither of the two items are given individual attention in the instructional materials but are rather

mentioned or part of another commands sheet. For example, the Text:Home command is mentioned at the end of the GR command handout.

3. The mean of the post test scores was an 80.35% with a minimum of 35% and a maximum of 95%. All questions but one were answered correctly by at least 78% of the students as can be seen in Table F3. The question which does not meet the standard is question 11.2. No student answered this question correctly with ten of the fourteen students not even attempting the question. In a post test discussion with the students eight of the fourteen expressed that they know how to solve the problem but could not explain how or why they solved it in a particular manner. The remainder of the students didn't understand what was expected from them. This item should be addressed in the lecture and a demonstration which shows why it is important to know how to order the sequence of a design should be added. A needs analysis to determine the need for training the students to improve their writing skills might also be in order.

4. Most students completed all of the assignments except those students with four or more days absence during this instructional period. This indicates that sufficient time was set aside for this instruction.

5. As seen in Table F6, the absentee rate and the rate of cutting had decreased.

Summative Evaluation

The data collected all seems to indicate that the module was effective and learning did take place. The use of both soft and hard data was used to support this module. The hard data used are the results of the performance checklist, evaluations of projects and the test grades with an item analysis. The soft data consist of the students reactions on the attitude questionnaire

and the students attendance records. The areas that will be discussed in this section are:

- A. Reaction
- B. Learning
- C. Behavior
- D. Results

which are the four levels of Kirkpatrick's approach to evaluation (Phillips, 1983). Kirkpatrick defines each phase of evaluation as follows:

1. Reaction: How well the student liked a particular training program. It is important to emphasize that it does not include a measurement of any learning that takes place.

2. Learning: Attitudes that were changed, and knowledge and skills that were learned. It does not include how this is to be applied.

3. Behavior: How the information is to used by the student.

4. Result: The evaluation of what changes in the student have occurred because of the project. This is an long-term evaluation. All of the data collected in the evaluation process can be located in Appendix 9.

Reaction:

The tool used to evaluate the students' reaction to the module was the attitude questionnaire. The data from the questionnaire indicates that the students appear to like the module. They are not overly excited about the module, but the mean score of the group's response all range above a three which is No Opinion, except in two areas. These items are asking if there are too many examples or too few examples in the lesson and by having a negative response they are answering favorably. The groups overall response was approximately a four, which stands for agreement. The sample of students' work located on the demonstration diskette emphasizes the time and energy the the students put into their assignments, and these are

students that don't do what they don't like. The designer concluded that the students liked the learning module.

Learning

The tools used to measure the amount of learning that took place in this module were the performance checklist and post test and evaluation of projects. The results of the checklist in the formative field trial section, indicate that 81.87% of objectives were passed by the students. If student A, whose percentage was well below the mean, was dropped the classes would have passed 86.4% of the objectives.

The students performed at approximately the same level on the post test. The overall mean of the post test was an 80.35% with a Standard Deviation of 16.07. The students had no knowledge of this subject before the instruction was started and for the entire group, excluding one, to score 71% or higher on the post test is, as far as the designer is concerned, a huge success. The student was given credit for completing an assignment only when the program made an exact replica of the graphed design assigned. The students had to have a transfer of learning from knowing what the commands do to using the commands. The conclusion the designer arrived at from the data collected is that the students did show a proficiency of the stated objectives and could program a computer in low resolution graphics on the Apple IIe.

Behavior

The behavioral change that the designer was looking for was for the students to want to write BASIC language programs. The proof that a change in the students did occur can be seen in the number of students that did complete all or a majority of the assigned program. Whereas before this the majority of the students would sit and wait for the instructor to go over the assigned program. The true indication as to whether the students do feel

differently to computer programming will be seen after the graphics module is completed and more mathematical programming is started. The time constraint on the class would not allow for the designer to monitor further.

During the project, one of the behaviors for which an improvement was to be gained from this lesson was attendance and motivation. A correlation of attendance showing the mean number of days out of class per student for fifteen days before the instruction -vs- the fifteen-day period the material was presented. The mean before was 5.07 days and during the instruction it dropped to 2.36 days. In performing a T-test using $df = 13$ and from the one tailed test using $\infty = .05$ the critical value was equal to 1.771. The T value calculated was 2.61. Therefore, a significant change had occurred.

The same correlation was done dealing with cutting class for the same duration and the *df* and critical value remained the same. The T value calculated 2.90 Therefore, a significant change was made during the period of instruction.

Whether the attendance would remain high after the instruction would require the keeping of the attendance records for a longer period of time such as the first fifteen days after the instruction to see if the motivation factor was still present.

Thought it was not the objective of the designer to improve attendance in the course, it is the designer's belief that the students are showing that because of the use of computer graphics, they do like to program the computer. Whereas before the module was introduced, students were not showing up at class because they did not like or understand the traditional method of introducing BASIC programming.

Results

The evaluation of the training program in terms of "results" is a very slow process (Kirkpatrick, 1987). The results the designer was trying to

achieve was to get students to want to write programs and learn the language BASIC. This can only be determined through observation throughout the term. The responses from the questionnaire indicate that they motivated to learn more about programming. The instructor would also look for the students to add graphics to programs that do not require graphics. The result envisioned by Kirkpatrick cannot be achieved in the New York City High School setting due to the fact that every five months the students program changes and new courses assigned, in many instances not using a computer. Because of this the designer only had two months to do any follow-up evaluation. The time constraints of this project and the school term did not allow for an evaluation of the results to be conducted. If the time was made available, the designer would conduct frequent observations of the students' work. The purpose of the observation would be to determine if the student is still interested in writing programs and if graphics are used in their programs.

Learning Transfer

The students are expected to use the information learned in this module and continue using it with other BASIC language commands. Methods that the designer used to insure that the students continued to use of graphics in their programs were: 1) Use graphic commands in examples that explained new commands and procedures; and 2) Reward students who used graphics, even if it was not necessary. The desired changes will only come about if the instructor and administration demonstrate consistent support to the transfer of learning (Broad, 1982).

Summary

The results of the evaluation point to a successful module of instruction. The formative evaluation did point out some flaws in the materials and test questions. The changes that were made proved to be correct and student understanding did improve. The students' inability to describe what they clearly know was disturbing to the designer and shows a need for improved writing skills on the part of the students. In the summative evaluation it was shown that the students did like the module, they did learn the material, and that some behavior changes where made. The changes that did occur will probably only be maintained if the instructor supports the transfer of learning to other programs the students will have to write during the term.

CHAPTER 7

SUMMARY AND RECOMMENDATIONS

Introduction

This is the final chapter of this project, and it explains what has taken place in the previous chapters. It further describes what actually occurred in the project, unlike chapter one which explained what was planned. The chapter also states the conclusions the designer came to during the implementation of the project. The designer's recommendations can also be found in this chapter. The recommendations of the designer and the concluding statement are also found in this chapter.

Method and Procedures Used

The method and procedures used in this project are based on the instructional system design model. The ISD model is comprised of five sections which are: analysis, design, development, implementation, and evaluation.

Analysis

In the analysis stage of this project four aspects of the project were conducted by the designer, needs analysis, identifying the instructional goals, reviewing existing literature and materials, and developing a project plan.

A needs analysis was performed. This was accomplished by conducting a job task analysis, identifying the target population and determining the organizational constraints. The project was created in response to the lack of student interest in computer programming which in turn caused a serious attendance problem. The target population was students enrolled in the course, Mathematics Computer Instruction 1 (MCI 1). The target population

was further involved in the course than the designer had originally planned. It was determined by the designer that this would not cause a problem. The organizational constraint was the amount of time in which the project could be carried out. This constraint was alleviated by the extension to three weeks from the original two which had been allotted.

The instructional goal and the five main tasks designated to achieve the instructional goal were identified. Each main task was further broken down into the tasks needed to achieve the goal. The materials created are to supplement the class lecture.

A comprehensive search for existing literature and materials was conducted and reviews of the material deemed appropriate were created. It was determined that although there are numerous materials on the subject, none was totally appropriate for the target population.

The designer developed a major events chart to keep track of the time and to circumvent conflicts that may arise. A PERT and Gantt chart was created. The analysis stage was completed with the planning out and creation of the budget.

Design

The design stage identifies the specific abilities that the student should possesses when the training is completed. At least one sub-task was identified in correspondence with each of the five main tasks identified in the job analysis. The sub-tasks were written into performance objectives using criteria, performance and conditions as the basis. Entry behaviors were established. The objectives were grouped to allow for a logical flow of instruction.

A lesson plan was created using Gagne's nine internal learning processes including method and media. An instructional strategy was developed for each objective. A combination of printed materials and still visuals was

selected to be the media chosen for the project. The time allotted was ten forty-minute sessions; this was found to be insufficient time, due to the number of projects that the students were to complete, thus, fifteen days was the actual time used.

The designers used three different tools to evaluate each student's progress during the project. The forms of evaluation used were a performance checklist, observation of program completed, and a post test. The designer also used two other means of evaluating the project which were the review of attendance records and an attitude questionnaire. The evaluation materials were used to perform the formative and summative evaluation.

Development

The development of the materials and lesson plans were based on the top-down approach to computer programming and Gagne's nine instructional events. The materials created were used to supplement the lecture. The materials were concept-tested after each section was created; feedback was provided and revisions were made. The performance checklist, post test and attitude questionnaire were created. All of the materials were reviewed for accuracy and mechanics and minor revisions were made. Twenty-three copies of the materials were prepared for students involved in the one-on-one, small group and field test group.

Implementation

Once the materials were created, they were presented to a group of three students who received one-on-one instruction. While this group was working with the materials, the designer was evaluating the materials based on the responses and work of the One-on-One group. Revisions were made to the materials and they where presented to a small group of six. The small group was presented with the materials in a normal classroom setting. Once

again the designer evaluated the materials based on the students work and responses on tests and questionnaires. The final presentation of the materials was given to a group of fourteen students who were enrolled in MCI 1. The students where presented the materials as described in the design stage and the designer evaluated the students and the materials through the use of the evaluation tools developed.

Evaluation

The materials were presented to three groups. A one-on-one group was presented with the materials and evaluated. Changes to the materials were made based on the information that was collected. A small group evaluation was performed with the revised materials and once again revisions were made based on the findings of the evaluation. The final version of the materials was presented to a field group similar to the target population. The length of time to complete the materials was extended to fifteen days from the originally planned ten days.

A summative evaluation was conducted to determine the value of the instruction. The results were analyzed and it was determined that the materials were learned, the students liked the materials, and a significant behavioral change took place. The designer encouraged the transfer of the students' knowledge to other parts of BASIC programming by using graphic commands in examples and rewarding students who used graphic procedures in their programs. This action was in response to a theory of Broad (1982), that the desired changes will only come about if the instructor and administration demonstrate consistent support to the transfer of learning.

Conclusions

The implementation and evaluation of the project led the designer to conclude that the hypothesis, teaching computer graphics would motivate the

students to want to learn BASIC programming, has credibility. The students were motivated to want to learn how to draw designs and were inquisitive about learning more efficient ways to create designs. The amount of time on task that the students maintained far exceeded any work the class had performed in the past. The effort of the students is shown on the computer diskette which gives a presentation of the students work.

At the conclusion of the project many students expressed to the instructor a desire to do other designs. The students were equally proud of their work and wanted printouts. The amount of time that the instructor was able to work with each individual student helped develop a very close student-teacher relationship, which was a key ingredient in the success of the project. The students' individual projects allowed for them to express themselves. No matter how simple or complex the design they developed, students were performing at a level above their past performance. Based on the students' responses and performance, the designer concluded that learning to write graphic programs as a means to learn beginning BASIC programming is an appropriate activity.

The designer was pleased with the results of the test in all aspects, except one. The designer was disturbed with the students' inability to express themselves when it came to explaining why they wrote a program in a specific order. The students showed that they had mastered the process of writing a program in the projects and tests, yet could not write why they wrote the program in the specific order. Since the goal of the project was to teach how to program and not how to write about programming, this cannot be seen as a shortcoming of the project. The problem disturbs the designer because it is important for the students to have a well-rounded education.

Recommendations

1. The materials created for this project were complete but it is the designer's belief that the true success of the project was due to the extensive student-teacher interaction. Thus the materials created are best suited for instructor led instruction rather than self instruction.

2. Graphics should be incorporated into the teaching of most of the other Apple BASIC commands, such as the use of variables, the FOR..NEXT and IF..THEN commands.

3. One of the most beneficial aspects of the project was the student had total control over their individual projects. The instructor must not give suggestions to the students on what to design or criticize the design that the student selects. When the student creates a very easy design and finishes early, then the instructor can give ideas to enhance the original design.

Concluding Statement

The project that is described in this paper is the result of considerable work on the part of the designer and students who participated in the project. The designer learned an enormous amount about the creation of learning material, and has developed enormous respect for those that do it correctly for a living. The designer is also a little envious of these people, because it is an interesting and fun process. One of the biggest lessons the designer learned in the process of the project was to accept the results of the evaluation and agree that some of the materials designed and thought to be good in the design stage were truly ineffective.

The designer was pleased that the project yielded the results that it did, and the students had as much fun learning as the instructor had teaching. There are many who will argue that the learning of programming is not important and the designer will not argue against that statement. But as long

as the powers that be dictate that programming most be taught, the designer feels that it should be as painless as possible. It is the designer's belief that this project starts the student programming as painlessly as possible.

The designer offers the materials created in this project to anyone else who must teach BASIC programming. Remember to make learning fun and, most important, interactive; there is nothing worse than a room full of students turning into stone.

Appendix 1

Student Survey

STUDENT SURVEY

NAME (OPTIONAL):_____

AGE: _____

GRADE:_____

1) Where were you born?

2) Are you presently scheduled to graduate on time?
If No, how far behind or ahead are you?

3) Have you passed the Math RCT?
How many times have you taken the exam?

4) Have you ever taken this course before?
If yes, why are you repeating the course?

5) What course do you like the most?

6) What course do you like the least?

7) What do you like about MCI 1?

8) What do you like the least about MCI 1?

9) How would you change the course if you were able make changes?

10) Would you like to learn to program the computer to create pictures as in the demonstration, even though the amount of work on your part is likely to increase greatly? Why or Why not?

Appendix 2

Task Analysis

TERMINAL PERFORMANCE OBJECTIVE: Given access to an Apple IIe and a Pre-Created graph drawing, the student will be able to write a structural sound BASIC program that will reproduce the graph to 100% accuracy

1.0 Change the screen from normal text mode to graphic mode

1.a Type the GR command to switch from normal text mode to graphics mode

1.b Type the TEXT:HOME to switch from graphics to text mode

2.0 Select a color

2.a Determine the number designation of the color wanted

2.b Type the COLOR = command followed by the number of the color selected

3.0 Determine which command to use

3.a Determine whether the point or points picked is a line or a single point

3.b Determine if a line is vertical or horizontal

3.c Select the command PLOT, VLIN or HLIN based on whether a single point Vertical or Horizontal line is needed

4.0 Calculate the x and y coordinates of desired points or lines

4.a Distinguish between x and y axis

4.b Find the x value for any point on the graph

4.c Find the value of any point on the grid

5.0 Write instructions into BASIC language instructions

5.a Identify a line of compute code as being immediate or program mode

5.b Classify sections of graph into separate sections

5.c Determine the order in which each section should be entered

5.d Determine order of commands PLOT, VLIN or HLIN to be used to complete each section

5.e Write commands in prescribed order using proper BASIC syntax

Appendix 3

Project Plan

MAJOR EVENTS AND TIMELINE

EVENT	WEEKS	START	FINISH
1. START	0	09/20/88	09/20/88
2. NEEDS ASSESSMENT	2	09/20/88	10/04/88
3. INSTRUCTIONAL GOAL	2	10/04/88	10/18/88
4. INSTRUCTIONAL TASK ANALYSIS	3	10/18/88	11/08/88
5. IDENTIFY ENTRY BEHAVIOR	1	11/08/88	11/15/88
6. PROGRAM DESIGN	2.5	11/15/88	12/02/88
7. DEVELOP LEARNING MATERIALS	5	12/02/88	01/06/89
8. IDENTIFIED TEST GROUPS	1	02/07/89	02/14/89
9. DESIGN DATA COLLECTION	3	02/07/89	02/21/89
10.CONDUCT ONE-ON-ONE TRIAL AND SMALL-GROUP EVALUATION	5	02/21/89	03/28/89
11.PILOT TEST	3	03/28/89	04/18/89
12.FORMATIVE EVALUATION	1	04/18/89	04/25/89
13.MAKE REVISIONS BASED ON TRIALS	1	04/25/89	05/02/89
14.IMPLEMENT PROJECT	2	05/02/89	05/16/89
15.SUMMATIVE EVALUATION	1	05/16/89	05/23/89
16.END	0	05/23/89	05/23/89

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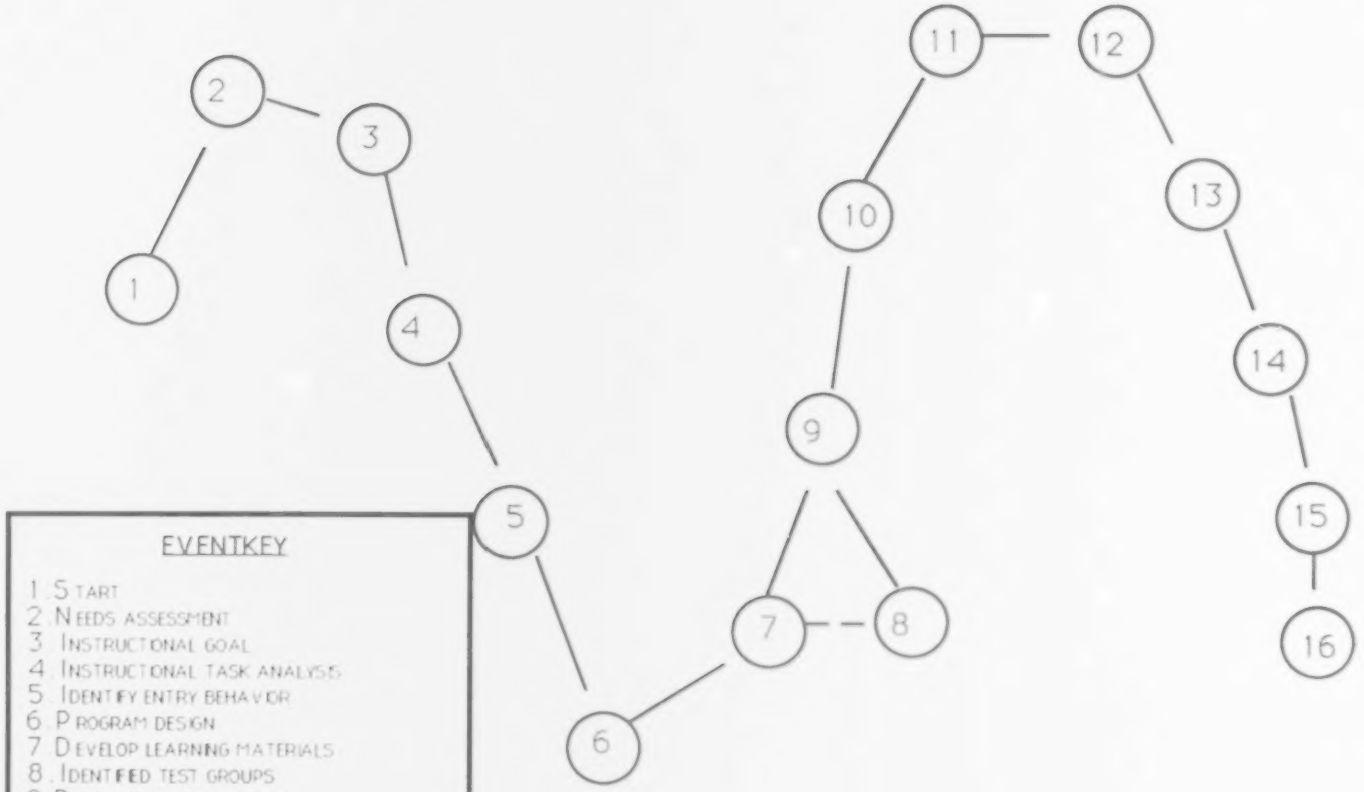
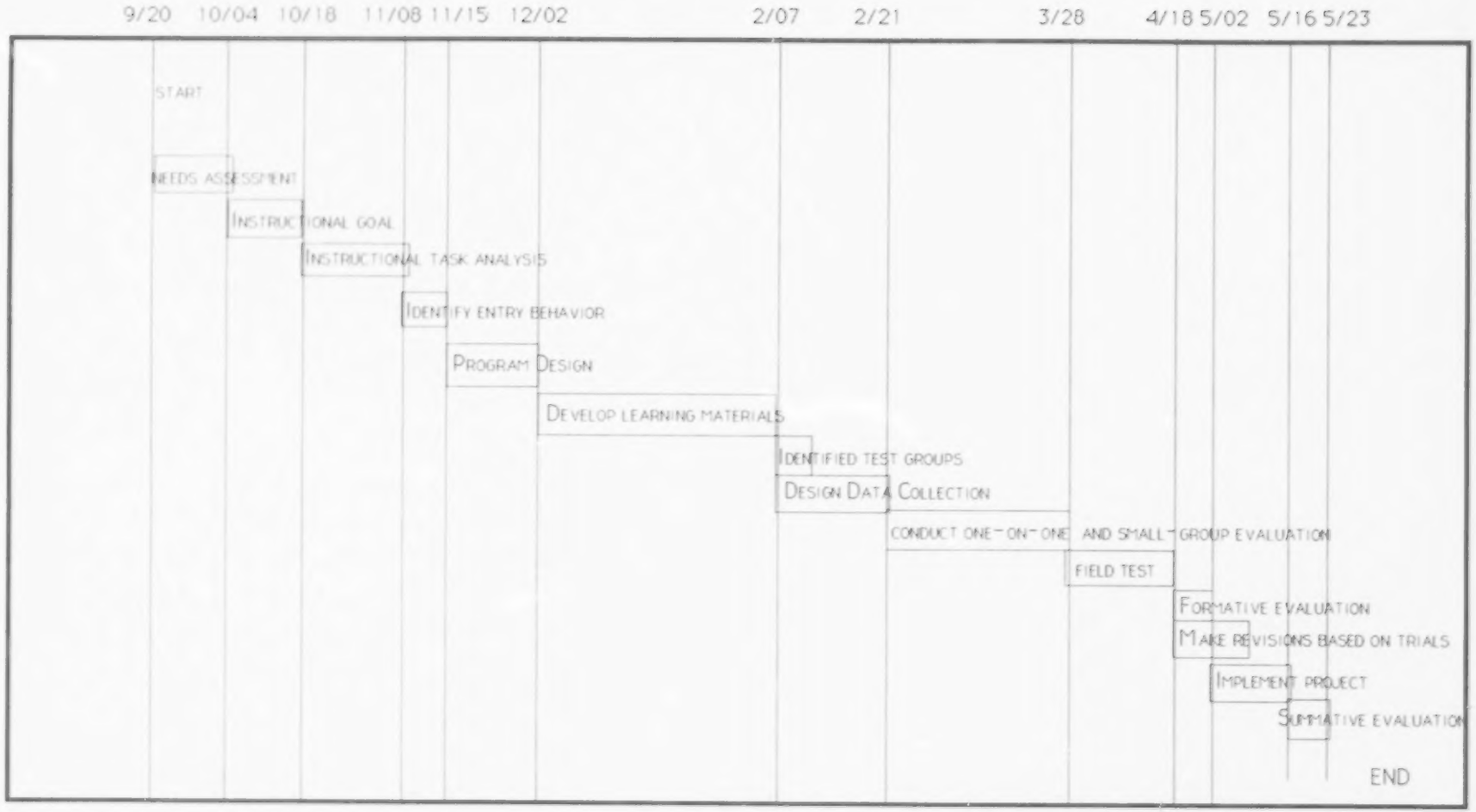
PERTCHART



EVENTKEY

1. START
2. NEEDS ASSESSMENT
3. INSTRUCTIONAL GOAL
4. INSTRUCTIONAL TASK ANALYSIS
5. IDENTIFY ENTRY BEHAVIOR
6. PROGRAM DESIGN
7. DEVELOP LEARNING MATERIALS
8. IDENTIFIED TEST GROUPS
9. DESIGN DATA COLLECTION
10. CONDUCT ONE-ON-ONE TRIALS AND SMALL-GROUP EVALUATION
11. FIELD TEST
12. FORMATIVE EVALUATION
13. MAKE REVISIONS BASED ON TRIALS
14. IMPLEMENT PROJECT
15. SUMMATIVE EVALUATION
16. END

GANTT CHART



S7

S8

Appendix 4

Performance Objectives

PERFORMANCE OBJECTIVES

1.a Type the GR command to switch from normal text mode to graphics mode	1.a Given the Apple IIe Computer whose monitor is in normal text mode, the student will enter the GR command to switch from normal mode to graphics mode. The switch must be made every time asked to switch from normal to text mode.
1.b Type the TEXT:HOME to switch from graphics to text mode	1.b Given the Apple IIe Computer whose monitor is in graphics mode, The student will enter the TEXT:HOME commands to switch from graphics mode to normal mode. The switch must be made every time asked to switch from text mode to normal mode.
2.a Determine the number designation of the color wanted2.b Type the COLOR = command followed by the number of the color selected	2.a While writing a BASIC language program involving graphics on the apple IIe, the student will use the COLOR = command followed by a number ranging from 0 to 16 to determine the color they want to select. The student must do this every time they are to select a new color to draw with.
3.a Determine whether the point or points picked is a line or a single point	3..a Given a sheet of graph paper with an assortment of designs the student will be able to determine whether the design selected is composed of points or lines. The design selected must be identified five of six times according to the standards of low resolution graphics.
3.b Determine if a line is vertical or horizontal	3.b Given a sheet of graph paper with an assortment of lines the student will be able to determine whether the the line selected is vertical or horizontal. The identification of the type of line must be correct five of six attempts according to the standards of the graph.
3.c Select the command PLOT, VLIN or HLIN based on whether a single point Vertical or Horizontal line is needed.	3.c Given a sheet of graph paper with a assortment of points and lines the student will determine which command to use, PLOT, HLIN and VLIN depending on what is being drawn, Point, Horizontal or vertical line respectively. The selection of the command must be done correctly three of foyr tries using the most economical method.

4.a Distinguish between x and y axis	4.a Given a sheet of graph paper the student will be able to label the X and Y axis. The labeling of the axis must be identified correctly in every instance according to the graphs specifications.
4.b Find the x value for any point on the graph	4.b Given a sheet of graph paper the student will be able to write the X value of any point on the graph. The X value of the point must correspond with with the value on the graph five of six times.
4.c Find the value of any point on the grid	4.c Given a sheet of graph paper the student will be able to write the Y value of any point on the graph. The Y value of the point must correspond with with the value on the graph five of six times.
5.a Identify a line of compute code as being immediate or program mode	5.a Given a line of computer code the student will be able to identify the code as being in immediate or programming mode. The line must be identified correctly according to BASIC language syntax four of four times.
5.b Classify sections of graph into separate sections	5.b Given a sheet of graph paper with a design drawn on it the student will be able to group each section of the graph into separate sections. The grouping will be based on size, shape or color similarities.
5.c Determine the order in which each section should be entered	5.c Given a sheet of graph paper with a design drawn on it and sections group the student will be able to determine the order for which each section will be coded into the computer. The order of entry must be selected so that no section overlaps another.
5.d Determine order of commands PLOT, VLIN or HLIN to be used to complete each section	5.d Given a specific section of a graph the student will be able to determine the order of the commands HLIN, VLIN and PLOT to be used to complete the section. The selection of the commands must be done in a manner so that all parts of the section will be drawn in the least number of commands.

5.e Write commands in prescribed order using proper Basic syntax	5.e Given a listing of graphic commands and an Apple IIe computer the student will write the commands in the correct order in program form. The program written must contain no syntax errors and should match the design on the graph paper.

Appendix 5

Instructional Strategy

INSTRUCTIONAL STRATEGY FOR THE INFORMATION PRESENTATION AND STUDENT PARTICIPATION

OBJECTIVE 1a
INFORMATION PRESENTATION:
INFORMATION:
The GR command is used to convert from the text mode to the graphic mode. The graphic screen is a screen over the regular screen.

EXAMPLES

1. Draw a screen on top of a screen on board.
2. Pull movie screen over board.
3. Use overhead to simulate a screen over a screen.
4. Have the student enter the GR command.

STUDENT PARTICIPATION:

PRACTICE:
1. Have student enter GR into computer.
1a. ASK "What happens to the screen when you enter GR and press return?"

FEEDBACK: Do same as students on large computer monitor, point out the sliding over of the graphic screen over the regular screen.

OBJECTIVE 1b

INFORMATION PRESENTATION:
INFORMATION:

The TEXT: HOME command and is used to convert from the text mode to the graphic mode. The graphic screen is a screen over the regular screen.

EXAMPLES:
1. Draw a screen on top of a screen on the board.
2. Pull movie screen up from board.
3. Use overhead to simulate a screen over a screen.
4. Have the students enter the TEXT:HOME command.

STUDENT PARTICIPATION:

PRACTICE:
1. Have students enter TEXT: HOME into the computer.
1a. ASK "What happens to the screen when you enter the TEXT:HOME and press return?"

FEEDBACK:
Do the same as students on large computer monitor and point out the sliding away of the graphic screen.

OBJECTIVE 2a

INFORMATION PRESENTATION:

INFORMATION:

To select or change the color of the lines to be drawn we use the command COLOR= and a number from 0 - 15. The command does not draw any lines, but only determines what color will be used when the command to draw lines is used.

EXAMPLE:
COLOR= 7 will tell the computer to draw the next line or points light blue. Prove the statement by doing this on the class monitor, then draw a line and see if it is the color we have said it would be.

STUDENT PARTICIPATION:

PRACTICE:
1. If 15 is the color white, what happens on the screen when the command COLOR= 15 is entered?
2. What happens in the memory?

FEEDBACK:
Remember the COLOR= command only selects the color but does not draw anything.

OBJECTIVE 3a

INFORMATION PRESENTATION:

INFORMATION:
a). A single dot on a graph is a point or a group of dots positioned diagonally are considered individual points.
b). Two or more dots on a graph together either right or left or up and down is considered a line.

EXAMPLES:
1. Use the overhead with a transparency of a graph. Draw a single dot or a diagonal line of dots and identify as a single point in graphics.

2. Use the same graph and draw an example of a line going across the screen and up and down the screen. Identify these as examples of lines.
3. Elicit the differences between the lines and points.

STUDENT PARTICIPATION:

PRACTICE:
1. Draw a line of dots on a graph. Have the students identify it as a line or a point. Ask why they had chosen their response.

FEEDBACK:

1. Provide students with the definitions of a line and point. Show on the board or overhead the difference between the two items.

OBJECTIVE 3b

INFORMATION PRESENTATION:

INFORMATION:

1. Two or more dots together on the graph (a line) which goes from left to right is called a HORIZONTAL line.

2. Two or more dots together on the graph (a line) which is positioned from top to bottom is called a VERTICAL line.

EXAMPLES :
1. Use an overhead and draw an example of each horizontal and vertical lines.
2. Use the computer with a large screen and demonstrate various horizontal and vertical lines.
3. Have them picture a sunset and say, "The sun sets on the horizon."
4. Have them picture a plane dropping out of the sky and state that a plane can make a 5000 foot vertical drop.

STUDENT PARTICIPATION:
PRACTICE:
1. Give the students graph paper with lines drawn on them. Have the students identify the lines as horizontal or vertical lines. Have them explain their answers.
2. Give examples of activities, ask if it is a vertical or horizontal motion. Ex. Helicopter taking off, car driving on a highway, running a 100 m. race, jumping for a rebound in basketball.

FEEDBACK:
1. Indicate why a line is vertical or horizontal.

OBJECTIVE 4a

INFORMATION PRESENTATION:

1. The numbers that run across the graph from left to right are the values for the x axis.

2. The numbers that run down the sides of the graph from top to bottom are the values for the y axis.
3. In Apple Low Resolution Graphics the values for either the x or y axis range from 0 to 39.

EXAMPLES:
1. Using the overhead and a transparency of a graph label the x and y axis. Also point out the range on the graph is 0 to 39.

STUDENT PARTICIPATION:

PRACTICE:
1. Give the student an unlabeled graph, have them label the x and y axis.

FEEDBACK:

1. Show the students the graph again and identify the x and y axis, using different colors to highlight the two.

OBJECTIVE 4b

INFORMATION PRESENTATION:

INFORMATION:

1. The X value tells you how far across the graph from left to right you are (Horizontal Value).

2. The values for the x range from 0 to 39. NO OTHER NUMBERS ARE PERMITTED.
3. To read the graph to get the value for X of a point move vertically to the top or bottom of the graph, which ever is closest, from the point. The number on the axis is the x value of the point.

EXAMPLES:

1. Use the graphed overhead with point already placed on the screen. Show how to go about determining the X value of the point.

STUDENT PARTICIPATION:

PRACTICE:

1. Have students respond to points the appear on the overhead.

2. Handout worksheet of graph and have them determine the x value of the points on the graph.

FEEDBACK:

Remind students of what the X value represents. Demonstrate to students how to read the graph.

OBJECTIVE 4c

INFORMATION PRESENTATION:

INFORMATION:

1. The y value tells you how far down the graph from top to bottom you are. (vertical value).

2. The values for y range from 0 to 39. NO OTHER NUMBERS ARE PERMITTED.
3. To read the graph to get the value for the Y of a point Move horizontally to the right or left of the point on the graph, whichever is closet from the point. The number on the axis is the Y value of the point.

EXAMPLES:
1. Use the graphed overhead with points already placed on the screen. Show how to go about determining the Y value of the point.

STUDENT PARTICIPATION:

PRACTICE:
1. Have students respond to points that appear on overhead.
2. Handout worksheet of graph and have them determine the Y values of the points on the graph.

FEEDBACK:
Remind the students of what the Y value represents.

OBJECTIVE 5a

INFORMATION PRESENTATION:

INFORMATION:

1. There are two methods in which we can give the computer commands.
   a. A command without a line number before the command, which tells the computer do the act right away. This is called IMMEDIATE MODE.

   b. A command with a line number before, which informs the computer to wait and store the command to be used with others. We get the computer to carry out the commands by typing RUN. Th is called PROGRAMMING MODE.

EXAMPLES:

1. On the overhead write out examples of the two types of modes.
   a. IMMEDIATE MODE
      i) PRINT "HELLO"
      ii) HLIN 5,6, at 7

   b. PROGRAM MODE
      i) 10 PRINT "HELLO"
      ii) 20 HLIN 0,3 at 39

2. Type the command into the computer and press return. Have students discuss the differences of the two types of commands.

STUDENT PARTICIPATION:

PRACTICE:

1. Have students identify in which mode a line of code is written.

FEEDBACK:

1. A line of code with a line number before it is in PROGRAM mode.
2. A line of code without a line number is in immediate mode.

OBJECTIVE 5b

INFORMATION PRESENTATION:

INFORMATION:
1. When we are trying to create a design with many parts, it is too confusing to try and take on the entire design at first. Organize the parts of the design by shape or colors and work on each smaller section separately.

EXAMPLE:

1. On the overhead show a complete design and break down or identify the sections.
2. On the large monitor show a complex graphic design. Then show how each section of the design was put together.

STUDENT PARTICIPATION:

PRACTICE:

1. Give the student, on graph paper, a complex design. Have them determine the sections that they would break the design down.

FEEDBACK:
1. Restate that the sections should be broken down by shapes or colors.
2. Show transparencies of design I had broken down into sections.

OBJECTIVE 5c

INFORMATION PRESENTATIONS:

INFORMATIONS:

1. To determine the order in which we write the program is determined in most is based on size. The largest section goes first and then we go down the list in descending order.

2. If you wanted a blue background with a green square, you would have to do the background first then the square or else you would draw over the square with blue.

EXAMPLE:
1. On the large screen show a demonstration of the blue and green. Demonstrate why the largest sections must come first.

OBJECTIVE 5b

INFORMATION PRESENTATION:

INFORMATION:
1. When we are trying to create a design with many parts, it is too confusing to try and take on the entire design at first. Organize the parts of the design by shape or colors and work on each smaller section separately.

EXAMPLE:

1. On the overhead show a complete design and break down or identify the sections.
2. On the large monitor show a complex graphic design. Then show how each section of the design was put together.

STUDENT PARTICIPATION:

PRACTICE:

1. Give the student, on graph paper, a complex design. Have them determine the sections that they would break the design down.

FEEDBACK:
1. Restate that the sections should be broken down by shapes or colors.
2. Show transparencies of design I had broken down into sections.

OBJECTIVE 5c

INFORMATION PRESENTATIONS:

INFORMATIONS:

1. To determine the order in which we write the program is determined in most is based on size. The largest section goes first and then we go down the list in descending order.

2. If you wanted a blue background with a green square, you would have to do the background first then the square or else you would draw over the square with blue.

EXAMPLE:
1. On the large screen show a demonstration of the blue and green. Demonstrate why the largest sections must come first.

2. On the graph have lines drawn; show how to read a line or point and get the command needed to create the line or point.
3. Using the examples discussed earlier, show where they should appear on the graph. Using the large screen monitor demonstrate to the class and insure them where it shows up on the graph it will appear on the screen.

STUDENT PARTICIPATION:

PRACTICE:
1. Have the students graph an assortment of commands on the graph. Have them enter the command into the computer to check if their graph matches the screen.
2. Give the students a graph that is broken into sections. Have them determine the commands to use to create the sections. Have the students run programs written and check for likeness of screen and graph.
3. Have student defend why they chose one command over another.

FEEDBACK:

1. Provide students with a list of how to create each command.
2. Remind the students to refer to graph if a white point is on a violet line, the line must be drawn first, then the point or else the line will cover over the point.

OBJECTIVE 5e

INFORMATION PRESENTATION:

INFORMATION:

1. After you have broken the design down the way we have it is very easy to put the commands into program form. Take the commands you have ordered and place a line number before each command. The line number must not be repeated and should be in ascending order. It would be a good idea to count by 5's or 10's.
2. REMINDER: The design will be created if the line numbers are not entered but there will be no means in which to save the design into computer memory. You would have to retype everything in order to do the design again.

EXAMPLE:
On a large monitor enter the commands the class had worded out in 5d. RUN the program and check results. Make corrections if needed.

STUDENT PARTICIPATION:

PRACTICE:

1. Have student work on projects they have been working with and have them enter the commands in the order they had worked out in 5c and 5d.

2. Students should RUN programs created and make corrections if needed.

FEEDBACK:

1. If PROGRAM has SYNTAX error: The computer will state with which line number it is having a problem. Have student list the line and determine what is wrong with the command given.

a). Remind student of the correct format of the PLOT, HLIN, and VLIN command.

2. If SCREEN doesn't MATCH GRAPH: Have the student identify what section is incorrect. Have the students identify what section of their program creates the section. Check to make sure all commands are entered into program and number match what was planned.

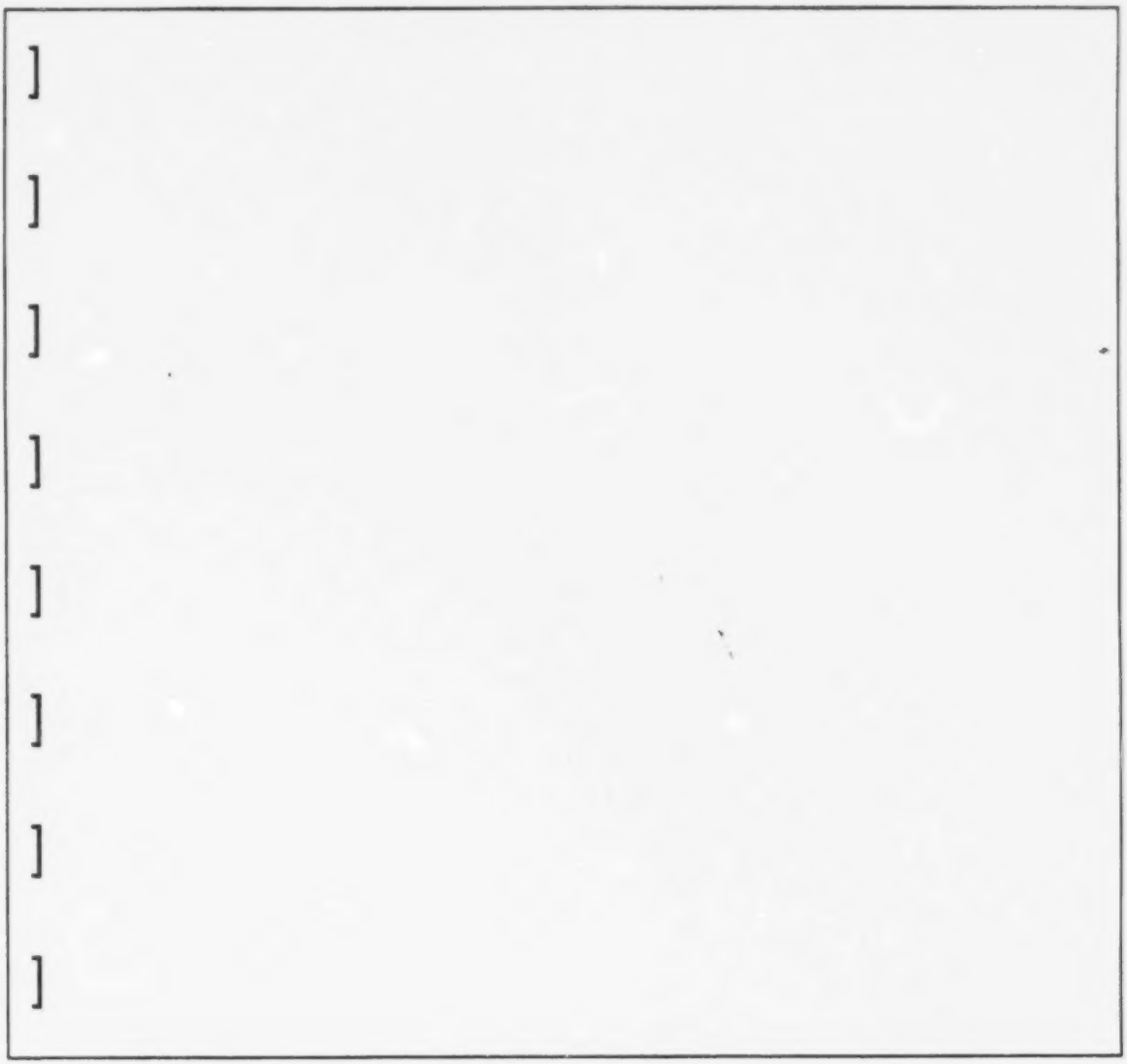
a. Was order of presentation correct?

3. Provide students with overhead to remain available to them throughout the process of writing the program. The overhead should outline the process of writing a graphics program.

Appendix 6

Instructional Material

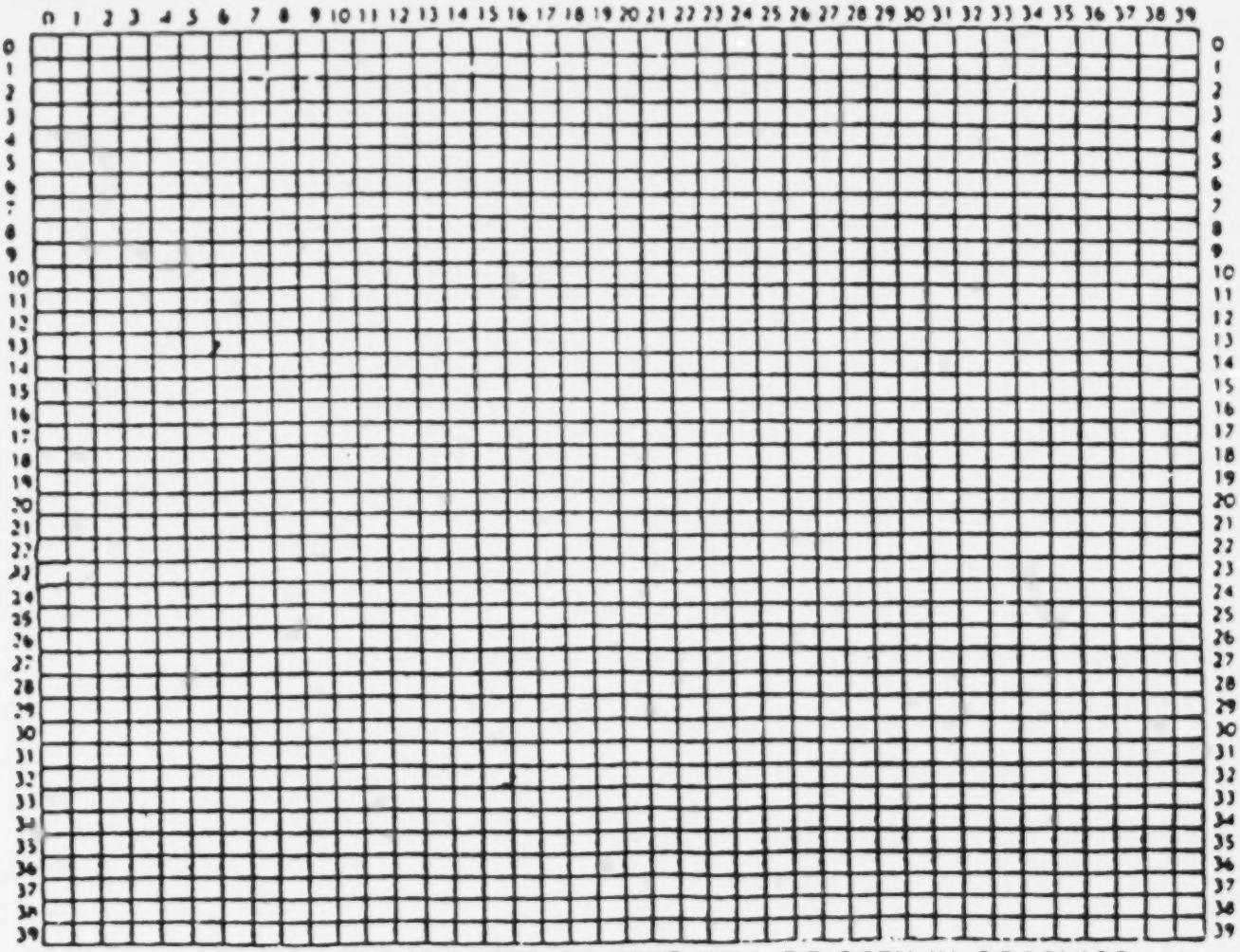
NORMAL TEXT MODE



SCREEN DIMENSIONS
HORIZONTAL: 40 SPACES ACROSS
NUMBERED FROM 1 TO 40
VERTICAL: 24 LINES FROM TOP TO BOTTOM
NUMBERED 1 TO 24

GRAPHIC MODE

TO SWITCH THE SCREEN FROM NORMAL TEXT MODE TO LOW RESOLUTION GRAPHIC MODE TYPE [GR] AND PRESS RETURN.



ONLY THE LAST THREE LINES OF TEXT WILL BE SEEN IN GRAPHICS MODE

TO RETURN THE SCREEN TO NORMAL TEXT MODE ENTER

[TEXT : HOME]

AND PRESS RETURN

COLOR CHART

The command to select a color is

COLOR = (# OF COLOR SELECTED)

There are 16 colors available, represented by the numbers 0 to 15.

0	BLACK
1	MAGENTA (RED)
2	DARK BLUE
3	VIOLET
4	DARK GREEN
5	GRAY -1
6	MEDIUM BLUE
7	LIGHT BLUE
8	BROWN
9	ORANGE
10	GRAY -2
11	PINK
12	GREEN
13	YELLOW
14	AQUA
15	WHITE

Example:

To select the color green enter,

COLOR = 12

PLOT

The PLOT command is used to draw a single point or a group of points in a diagonal. The plot command will draw only one square of the grid at a time.

PLOT x, y

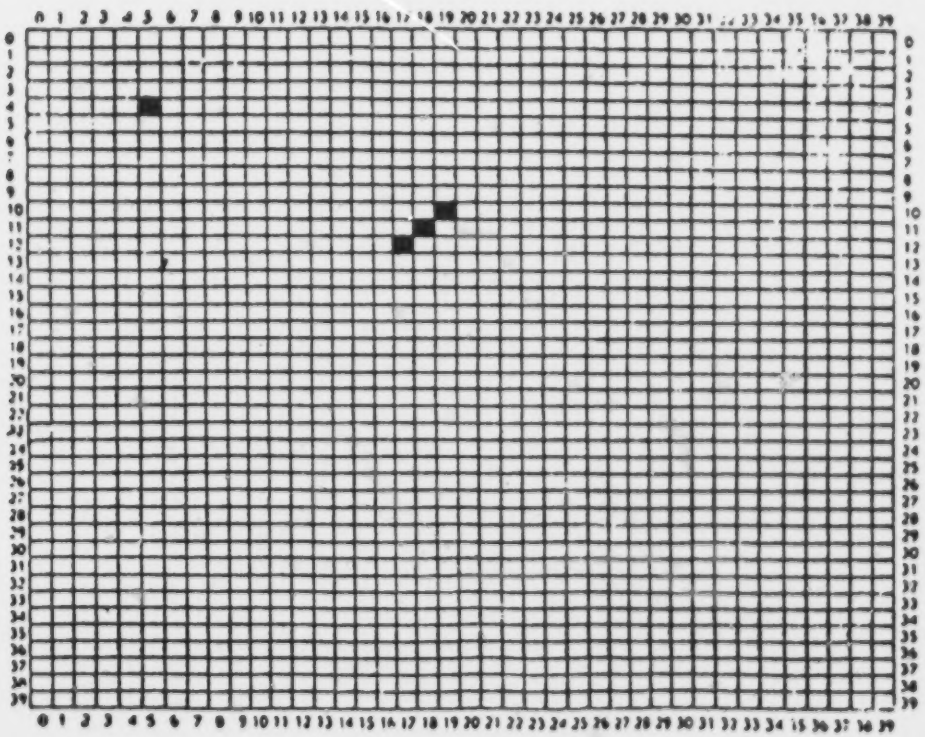
X: The x value is the horizontal number on the top or bottom of the chart.

Y: The Y value is the vertical number on the sides of the chart.

Example :

A) PLOT 5,4

B)
```
PLOT    17,12
PLOT    18,11
PLOT    19,10
```



HLIN

The HLIN command is used to draw two or more horizontal grids at a time.

HLIN x1,x2 AT y

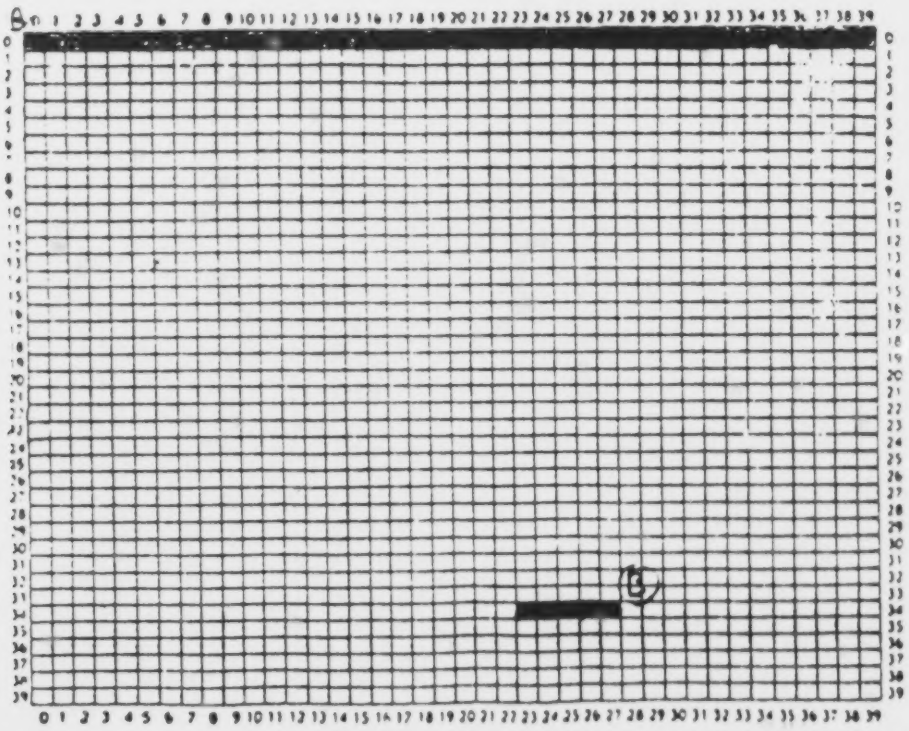
x1: The x value for which the horizontal line starts.

x2: The x value for which the horizontal line ends.

y: The value which states on which vertical line it will appear.

Example:

A) HLIN 0,39 AT 0 B) HLIN 23,27 AT 34



VLIN

The VLIN command is used to draw two or more vertical grids at a time.

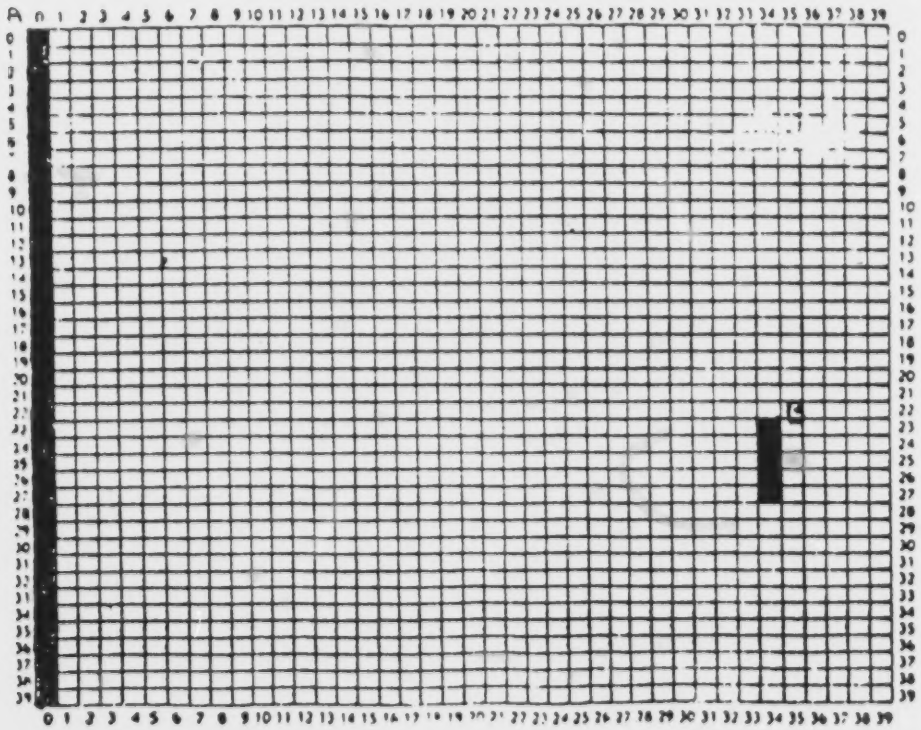
VLIN y1,y2 AT x

y1: The y value for which the vertical line starts.

y2: The y value for which the vertical line ends.

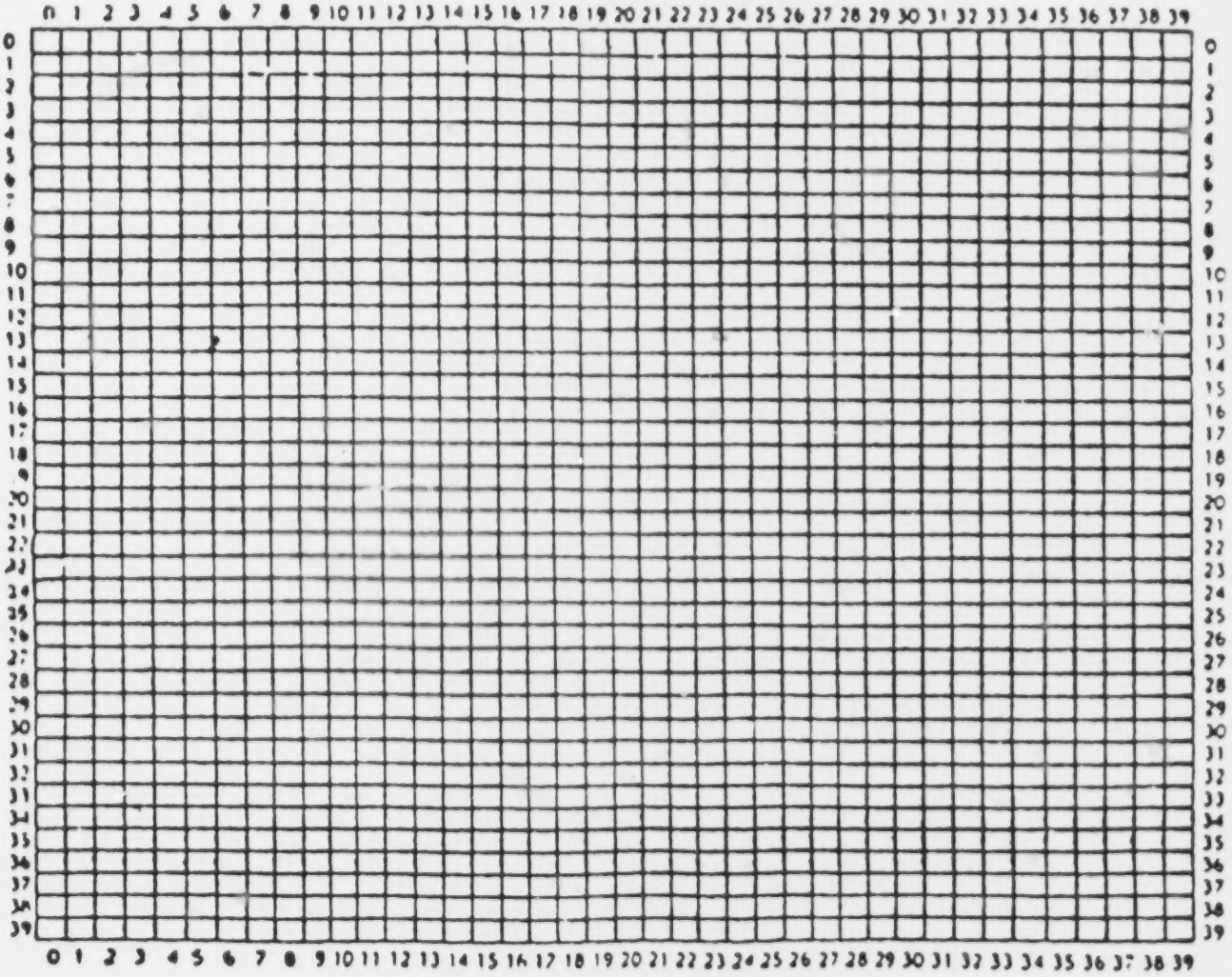
x: The value which states on which horizontal line it will appear.

Example:
A) VLIN 0,39 AT 0 B) VLIN 23,27 AT 34



GRAPHIC WORKSHEET :

Use this sheet to assist you in the planning and programming of your graphic design.



LESSON 1: Low Resolution Graphics

AIM: What is Apple Graphics?

PERFORMANCE OBJECTIVES: (The student will be able to ....)

1. Type the command to switch the screen from text to graphics mode.
2. Select a color to draw with using the COLOR = # command

DO NOW: Load the demonstration program into the computer and RUN the program.

DEVELOPMENT:

1. Allow students to work through program, assist students who are having problems:
   a. Have students comment on the program,.
   b. Ask: How would you like to create designs of your own on the computer? Inform students that in a matter of days they well be able to do so.
2. Introduce the GR command:
   a. Have students type GR in and press RETURN.
   b. Discuss what they think has occurred.
   c. On overhead show example of normal screen, place example of graphics screen on top. This gives an example of what occurs when the GR command is entered.
   d. Elicit: The GR command switches the text screen for the graphic screen.
3. Introduce the TEXT: HOME COMMAND:
   a. Have students enter TEXT: HOME and press return.
   b. Discuss what they think has occurred.
   c. Use overhead to show what has happened.
   d. Elicit: The TEXT:HOME command switches. The screen from the graphic mode to normal or TEXT mode.
4. Inform the student that to create graphic they have to first turn the computer screen into graphic mode and second select a color:
   a. Show color chart on overhead.
   b. Explain the number is the code for the color.
   c. The way we select a color is COLOR = #.
   d. Have students enter COLOR = #.
   e. Ask: What happened? Explain: It appears nothing happens because the COLOR = command only selects a color, it does not draw. The process that did occur is the color in which you want to work with is known to the computers memory.

APPLICATION:

1. Have student switch from GRAPHIC to TEXT screen.
2. Have students enter the color command, then type PLOT O,O.

Explain:

The color they select should appear in a dot in the upper left corner.

SUMMARY:

How do we get to the Graphic screen?
How do we get to the TEXT screen?
How do we select a color to draw with?

LESSON 2

AIM: How do we place paints on the screen?

PERFORMANCE OBJECTIVES: Each Student Will Be Able To:
1. Determine whether a point or a group of points is a line or a single point.
2. Distinguish between a horizontal or a vertical line.
3. Identify the X and Y axis on the graphic grid.
4. Use the Plot command to place points on the screen.

DO NOW /MOTIVATIONS:

Answer the following questions, use your notes to help:

1. How would you select the color brown? (COLOR=)
2. What command brings the computer to the NORMAL mode? (TEXT: HOME)
3. What must be the first command to work in graphics? (GR)

DEVELOPMENT
1. Go over do now problems. Have student ask questions and explain to each other the results.
2. Distribute the graph worksheet:
    a. Have example of it on overhead.
    b. Explain that in graphic mode the computer breaks the screen down to a 40 x 40 screen; the columns and rows are numbered 0 to 39.
    c. Using the overhead have students take notes and refer to their own graph.
3. Show the difference between a point, and line:
    a. Any single point or group of points in a diagonal are considered to be separate points in low resolution graphics.
    b. Any two or more points together vertically, or horizontally, are lines.
4. Give examples between horizontal and vertical lines.
5. Point out and have students label X and Y axis:
    a. The lines going from left to right are x axis.
    b. The lines going up and down are y axis.
6. Explain how to draw a point:
    a. Introduce the PLOT x, y command:
        1. To use the plot command you must determine the x value and y value of a point. x = 19 y = 20.

2. Color in one grid on the overhead graph.
    a. Have students determine the x value.
    b. Have students determine the y value.
3. Have students turn on computers and enter PLOT 19,20
    a. Why didn't it work?
        1. Always enter the GR first.
        2. Select a color.
        3. Then draw.
    b. Have students do above and try again. Does it appear in the same areas as the overhead?

7. Color in other grids and have students plot out points.

APPLICATIONS:

PLOT a different color point in each corner of the screen.

SUMMARY:
1. How do we distinguish between a point and a line?
2. How do we draw points on the screen?

HOMEWORK.
Worksheet with points on it in different colors. Students are to determine the proper COLOR command and PLOT command.

Lesson 3

AIM: How do we draw lines?

PERFORMANCE OBJECTIVES: To Be Able To:
1. Use the HLIN and VLIN command to draw horizontal and vertical lines.
2. Determine which command should be used between PLOT, HLIN, VLIN.

DO NOW /MOTIVATIONS:
1. Hand out graphs with points. Draw on them. Have students:
   a. Determine the x and y coordinates.
   b. Create a program that will draw them on the computer in the color of the number next to it.

DEVELOPMENT:

1. Go over do now problems. As students are working on programs, assist students individually or in small groups.
2. Ask students to draw on graph across the top of screen.
   Ask: 1. How would we have to have this drawn on the computer:
   a. Write on board the responses: PLOT O,O , PLOT 1,0 , PLOT 2,0.
   b. Ask: " Wouldn't it be nice if there was one command to do?"

   Ask: "What is two or more points that go from left to right across the screen?"
   Elicit: "HORIZONTAL LINE"

Explain: How to create a horizontal line as:

COMMAND	1ST POINT ,	2ND POINT	at	Y level
HLIN	0 ,	39	at	0

Have students enter and see what it does.

3. Do same as 2, after having students draw a line up and down left side of screen on graph.
ELICIT: " VERTICAL LINE"

Explain: How to create a vertical line as command.

COMMAND	1ST POINT	2ND POINT	at	x point
VLIN	O,	39	at	0

4. Have student use the command to finish a border around the screen.

APPLICATIONS:

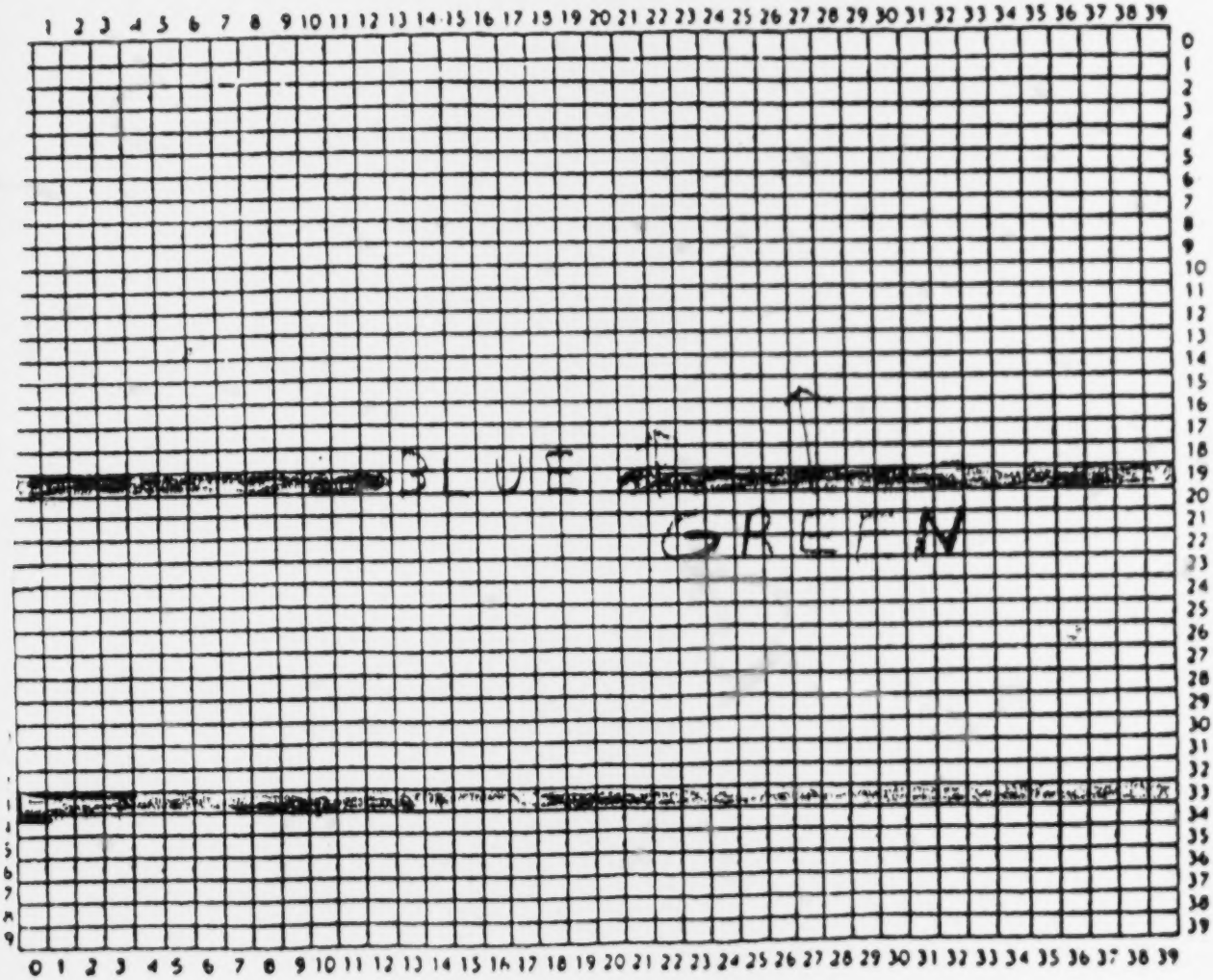
1. Hand out work sheet with lines and points and have students write a program to draw each line / point a different color.
2. As students work on sheets circulate and assist students.

SUMMARY:

How do we draw HORIZONTAL LINES?
How do we draw VERTICAL LINES?

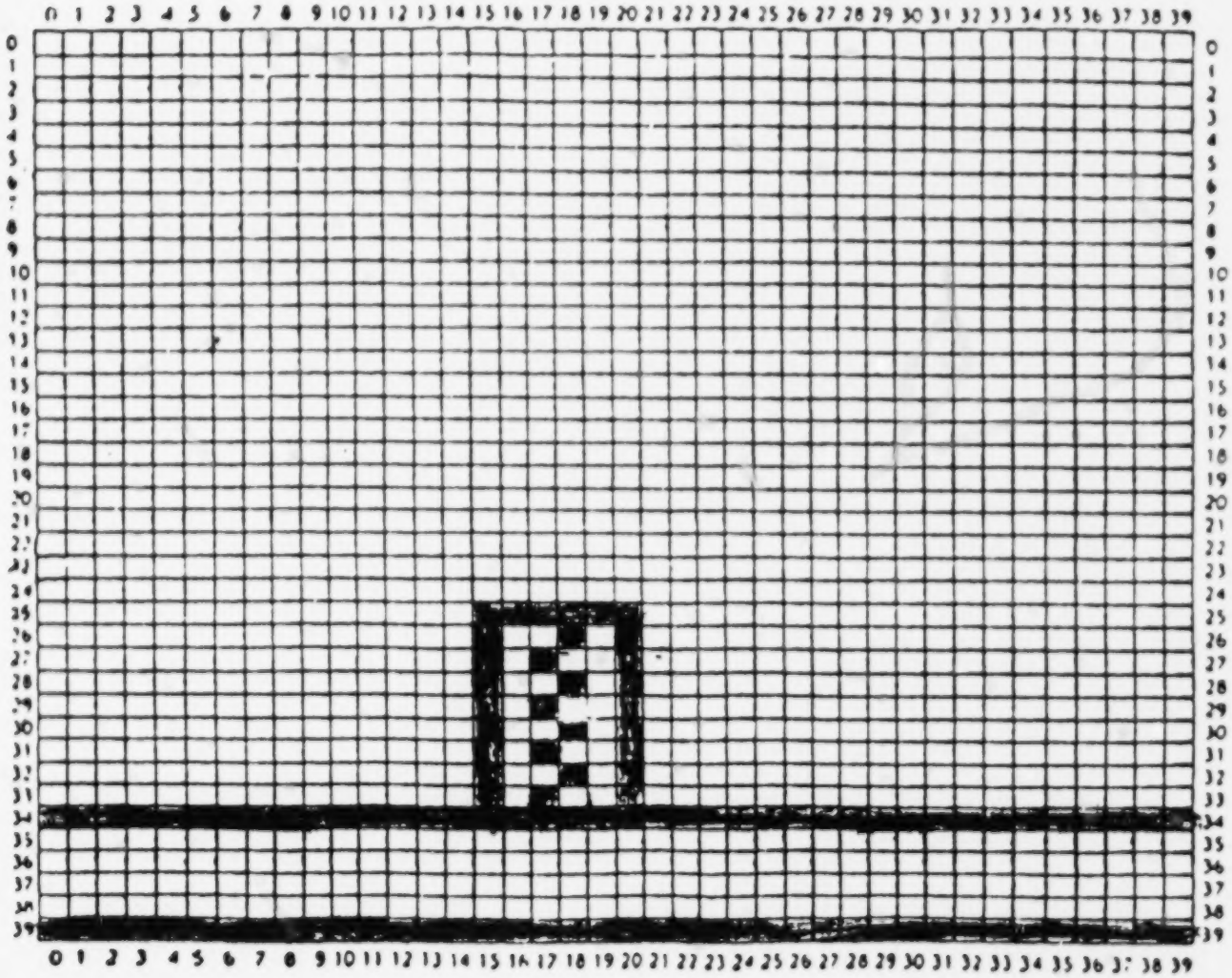
PROJECT 1.1

Write a program that will create the design drawn in the graph below. Number the line numbers in you program between 1 and 300. Save the program to your diskette, call the program **graph1.**



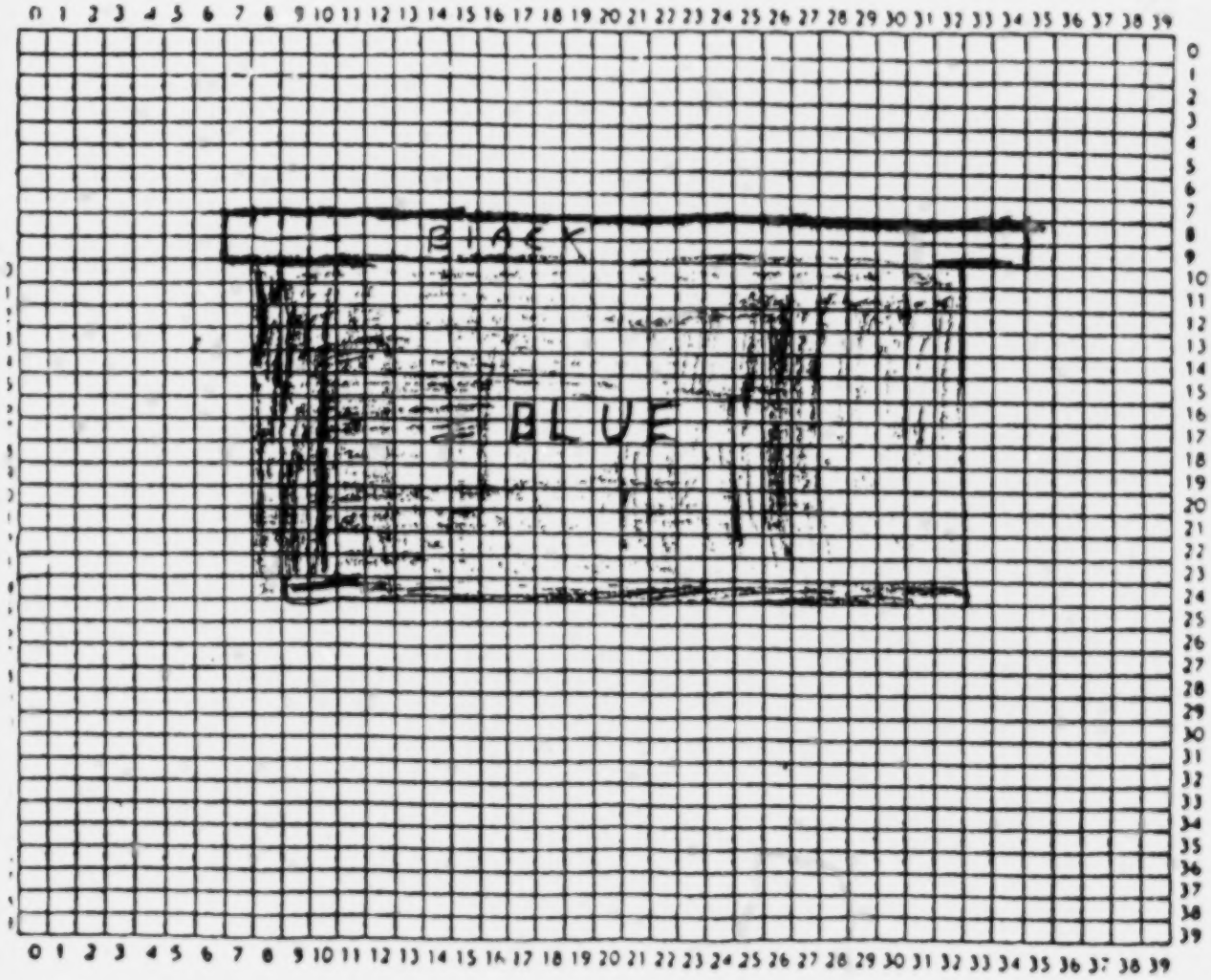
PROJECT 1.2

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 301 and 500. Save the new program to your diskette using the same name **graph1.**



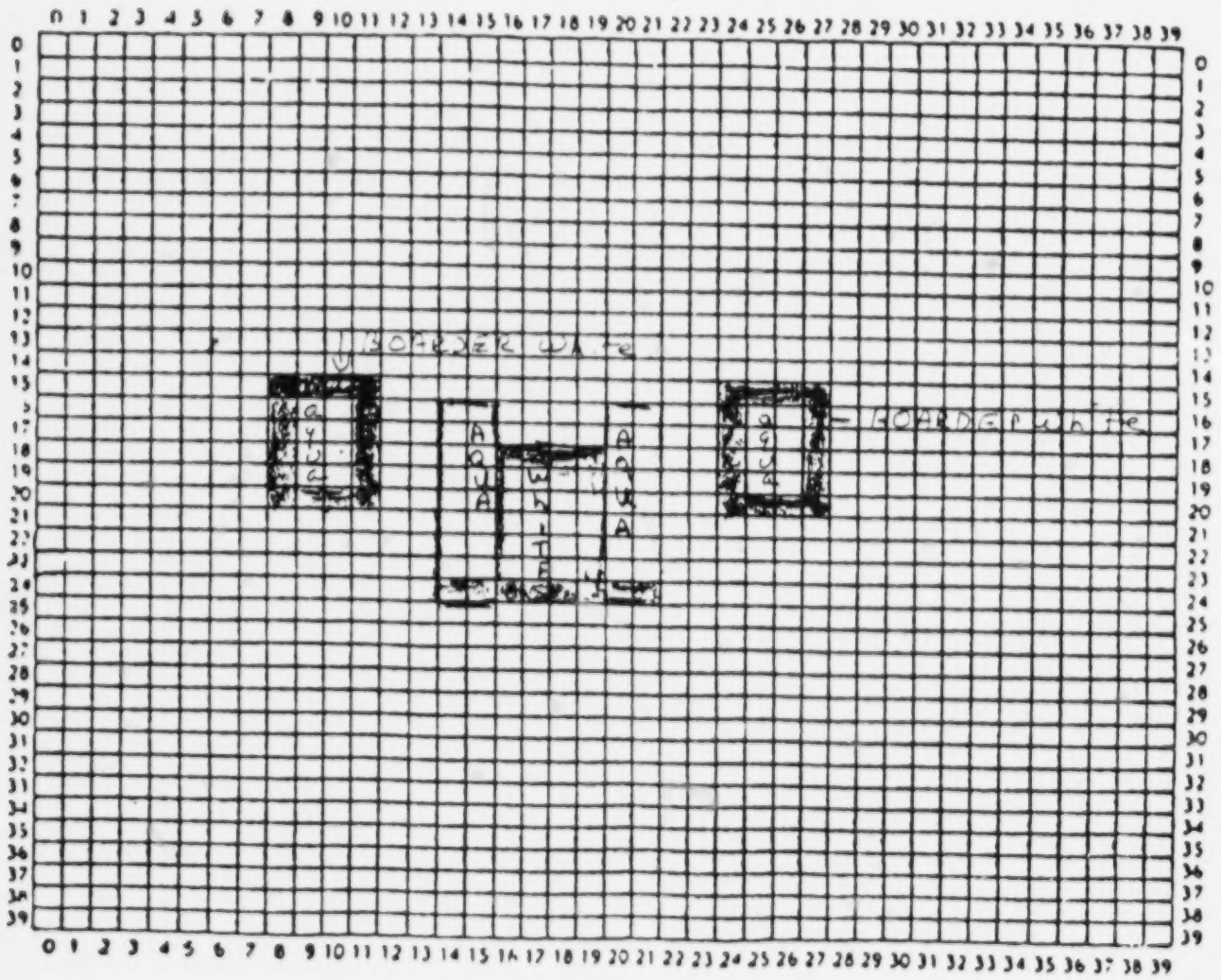
PROJECT 1.3

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 501 and 700. Save the new program to your diskette using the same name **graph1.**



PROJECT 1.4

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 701 and 1000. Save the new program to your diskette using the same name **graph1.**



Appendix 7

Evaluation Materials

PERFORMANCE CHECKLIST

TASK: Given access to an Apple IIe computer and a pre-created graphed drawing, the student will be able to write a structurally sound BASIC language program using the command HLIN, VLIN, and PLOT to create the design on the graph.

STUDENT NAME _____DATE ___/___/ 89

Directions : Enter a G (GO) or NG (NO GO) to indicate whether the student performs each task as indicated.

1. ___ Types the command GR when asked to switch screen from text to graphics mode.
2. ___ Types the command TEXT:HOME when asked to change the screen from graphic to text mode.
3. ___ Enters the COLOR = # command when asked to select a color.
4. ___ Identifies correctly 5 of 6 times whether an item on the graph is a point or line.
5. ___ Identifies correctly 5 of 6 times whether a line is vertical or horizontal.
6. ___ Correctly labels the X and Y axis of the graph.
7. ___ Correctly states the X value of a point on the graph.
8. ___ Correctly states the Y value of a point on the graph.
9. ___ Identifies 5 of 6 times the correct command to draw a specific point or group of points.
10. ___ The student, once given a design on the graph, is able to break the design into major sections using color and shape.
11. ___Student outlines the order to which each section should be entered in the program.
12. ___Uses the correct command and coordinate values to create a particular section of the graph.
13. ___Uses the command created in 12 and places them in program form in the proper order to create the design.

POST TEST

SECTION: Graphics

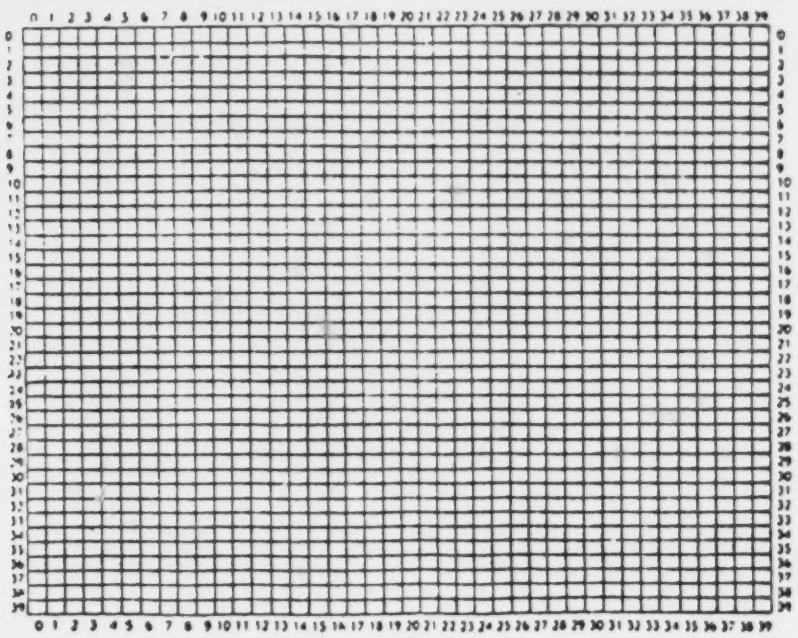
NAME _____ DATE _____

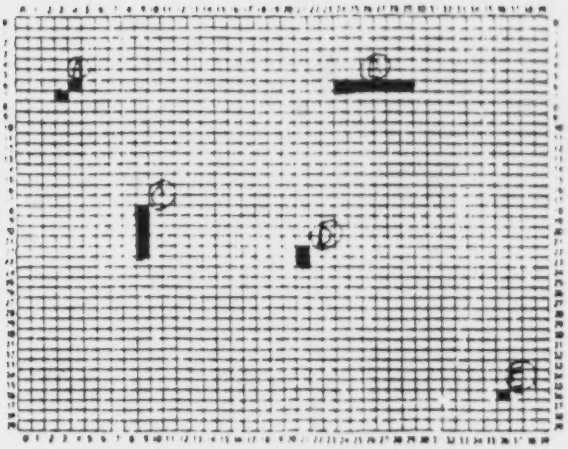
1. What command must you enter to switch the Apple IIe's screen from text to graphic mode? _____

2. How do you switch the screen from graphic to normal mode? _____

3. After You have selected graphic mode, what should be the next major command? Explain what it does.

4. Using the graph provided, below label the x and y axis.





Use the graph above to answer questions 5 and 6.

5. Identify each item on the graph as a point or a line.

A)_____

B)_____

C)_____

D)_____

E)_____

6. Determine the best command to use to draw each item.

A)_____

B)_____

C)_____

D)_____

E)_____

7. Determine the X value of the points A thru E on the graph below.

A)_____

B)_____

C)_____

D) _____

E) _____

8. Determine the y value of the points F thru J on the graph below.

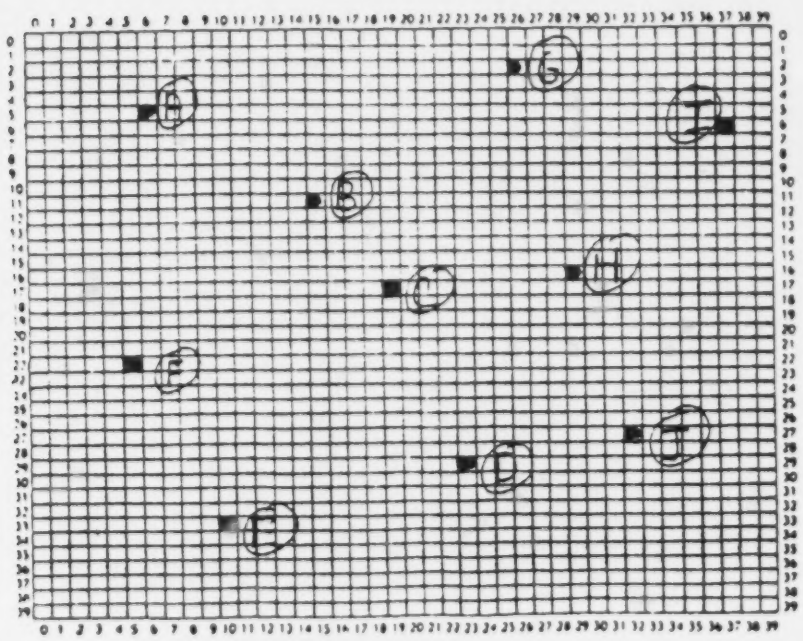
F)_____

G)_____

H)_____

I)_____

J)_____



9. Write the command that would draw each of the items in the graph below.

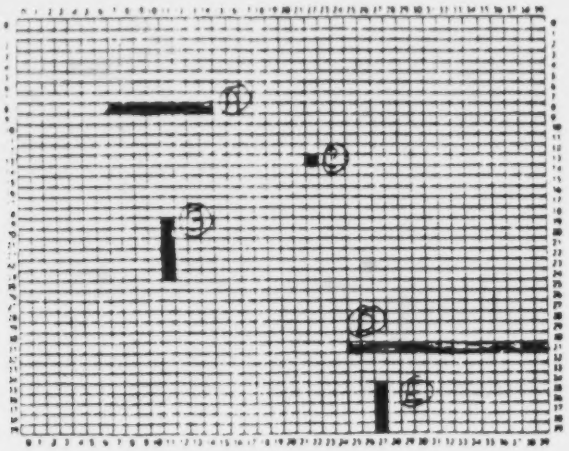
A)_____

B)_____

C)_____

D)_____

E)_____



10. Draw on the graph what each of the following commands would create on the screen.

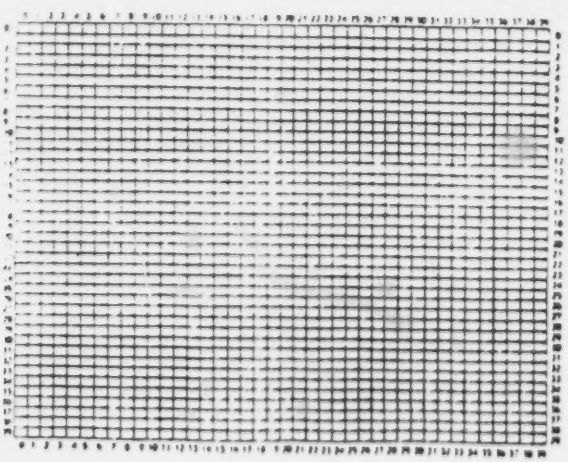
A) PLOT 7,9

B) VLIN 4,5 AT 31

C) VLIN 1,39 at 39

D) HLIN 12,15 AT 30

E) PLOT 34,36

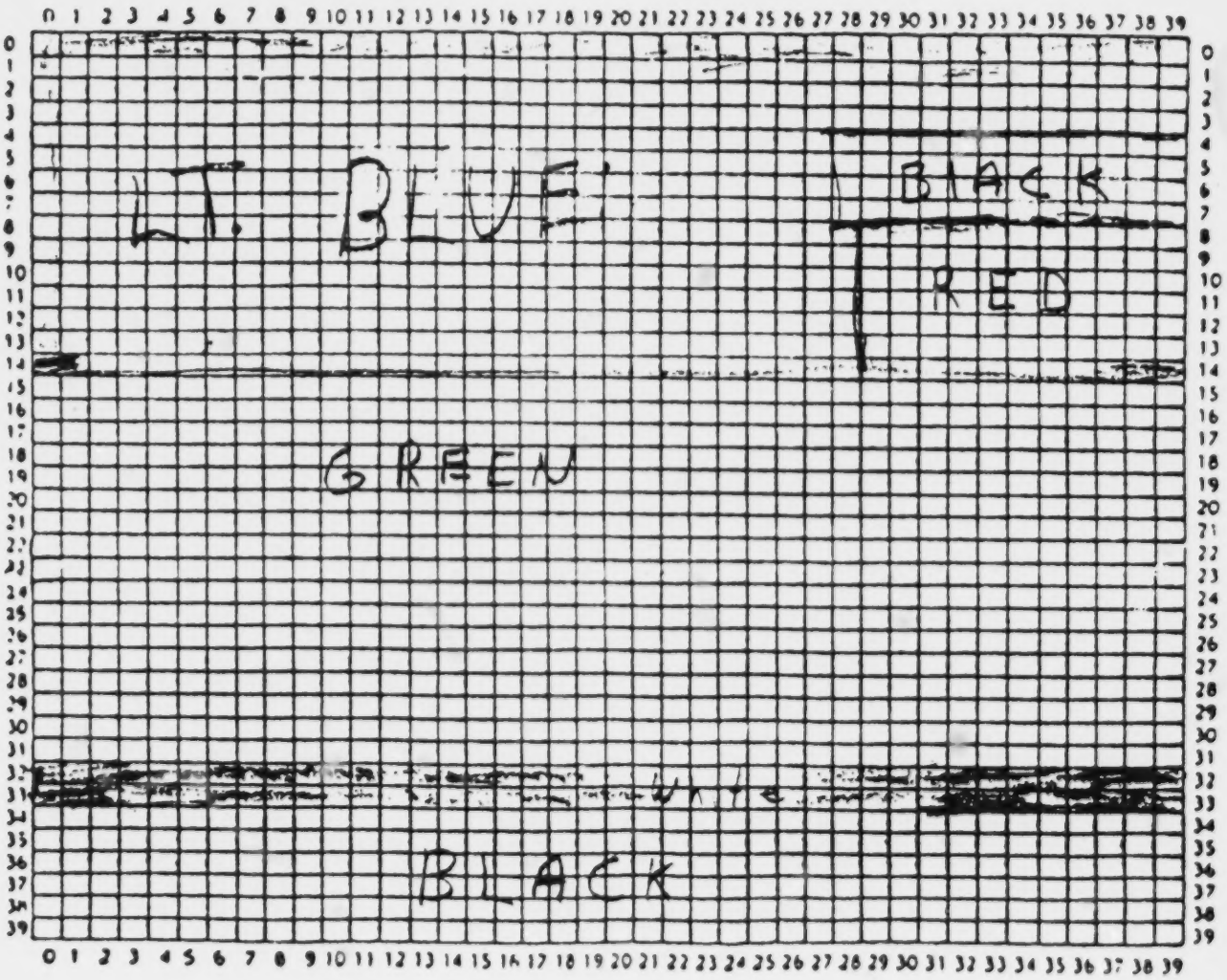


11. Using the design on the graph determine how you would write the program that would produce the design.

1) Break the design into sections according to size and color.

2) State the order you would use to enter each part. Explain your selection of the order.

3) Write the program that would produce the design.



Attitude Questionnaire

Circle the the answer that best suits your opinion of the question:

1. Strongly Disagree
2. Disagree
3. No Opinion
4. Agree
5. Strongly Agree

A. Motivation

1) Did you like the beginning demonstration?

1 2 3 4 5

2) Do you like creating graphic images on the computer?

1 2 3 4 5

3) Would you like to spend more time working with graphics?

1 2 3 4 5

4) Did the demonstration and instruction make you want to create you own design?

1 2 3 4 5

5) What do you feel would have made the demonstration better?

B. Objectives:

1) Do you understand how to switch the screen between it two modes?

1 2 3 4 5

2) Did you understand that you would be learning the difference between the three graphic commands and how to use them?

1 2 3 4 5

3) Did you want to learn more about computer programming?

1 2 3 4 5

C. Test

1) Do you think the items on the performance checklist were clear?

1 2 3 4 5

2) Do you think most of the questions on the test were clear?

1 2 3 4 5

3) Did you understand what you had to do in project 1?

1 2 3 4 5

4) If you were not happy with either the Checklist, Test, or Project explain why.

D. Instruction

1) Was the instruction interesting?

1 2 3 4 5

2) Was the instruction clear?

1 2 3 4 5

3) Were the examples helpful?

1 2 3 4 5

4) Were there too many example?

1 2 3 4 5

5) Were there too few examples?

1 2 3 4 5

6) Did the practice questions help you?

1 2 3 4 5

If not, why not?

7) What could have been done to make the instruction better?

E) Overall

1) Generally, did you like the lesson?

1 2 3 4 5

2) Did you learn to do things you couldn't do before?

1 2 3 4 5

3) What do you think could be done to improve the lesson?

Appendix 8

Sarah J. Hale's High School

Lesson Plan Guideline

LESSON PLAN POLICY

Proper lesson planning is one of the key elements leading to success in the classroom. In consonance with this and with High School Memorandum Number 24 (October 24, 1980), herewith are the parts of a lesson plan:

TOPIC: NUMBER : DATE:

Aim:
Performance Objective(s)
Motivation
Materials
Pivotal Questions/Activities

Board Outline
Expected Pupil Response

Medial Summary
Summary/Application
Assignment
"Each teacher is to prepare a written daily lesson plan for each lesson taught. The plan is to be explicit, reflective of the course of study, and is to be readily available."

It is expected that all teachers given written homework assignments at least twice a week and that academic classes endeavor to give written homework assignments every day. The Assistant Principals Supervision will be working with their respective Departments to "flesh out" homework and lesson policies in detail.

Appendix 9
Evaluation Results

TABLE O1

ONE-ON-ONE PERFORMANCE CHECKLIST

STUDENT	OBJECTIVE													PERCENT OF OBJ. PASSED BY STUDENT
	1A	2A	3A	3B	3C	4A	4B	4C	5A	5B	5C	5D	5E	
A	X	X	X	X				X	X	X		X	X	84.62
B	X	X	X		X	X	X	X	X	X	X	X	X	92.31
C	X	X	X	X	X	X	X	X	X	X	X	X	X	76.92
MEAN	100	100	100	67	67	67	100	100	100	100	100	100	100	X = 92.3

TABLE 02

ONE-ON-ONE POST TEST

STUDENT	TEST GRADE (%)
A	90
B	95
C	85

MEAN	90
MODE	N/A
MEDIAN	90
STANDARD DEV.	5

TABLE 03

ONE-ON-ONE ITEM ANALYSIS POST TEST

OBJECTIVE	ITEM RELATED TO THE OBJECTIVE	100-91%	90-71%	70-51%	UNDER 50%
1 a	1	1			
2 a	2	2			
3 a	3			3	
3 b	5	5			
3 c	9(A-E) & 6(B-C)	9(A-E)&6(B-C)			
4 a	5(A-E)	5(A-E)			
4 b	7(A-E)	7(A-E)			
4 c	8(A-E)	8(A-E)			
5 a	6(A-E)&9(A-E)	6(A-E)&9(A-E)			
5 b	11.1				11.1
5 c	11.2			11.2	
5 d	10(A-E)	10(A-E)			
5e	11.3	11.3			

TABLE O4

ONE-ON-ONE QUESTIONNAIRE RESULTS

	A				B			C			D						E	
STUDENT	1	2	3	4	1	2	3	1	2	3	1	2	3	4	5	6	1	2
A	2	5	4	4	5	5	5	4	4	5	4	5	5	4	2	3	5	5
B	3	5	5	3	5	5	4	5	4	4	5	5	5	5	2	3	5	5
C	1	5	4	2	5	5	3	4	4	5	4	5	5	5	2	3	5	5
MEAN	2	5	4	3	5	5	4	4.3	4	5	4.3	5	5	5	2	3	5	5

5 STRONGLY AGREE
4 AGREE
3 NO OPINION
2 DISAGREE
1 STRONGLY DISAGREE

TABLE 05

ONE-ON-ONE EVALUATION OF PROJECTS

STUDENT	PROJECT				
	1.1	1.2	1.3	1.4	2
A	X	X	X	X	X
B	X	X	X	X	X
C	X	X	X	X	X

X = COMPLETED ASSIGNMENT

TABLE S1

SMALL GROUP PERFORMANCE CHECKLIST

STUDENT	OBJECTIVE													PERCENT OF OBJ. PASSED BY STUDENT
	1A	2A	3A	3B	3C	4A	4B	4C	5A	5B	5C	5D	5E	
A	X		X	X		X	X	X	X	X		X	X	76.92
B	X		X	X	X	X	X	X	X	X	X	X	X	92.31
C	X	X	X		X			X	X	X	X	X	X	76.92
D				X	X				X			X		30.77
E		X	X	X	X	X	X	X	X	X	X	X	X	92.31
F	X	X	X	X	X	X	X	X	X	X	X	X	X	100
MEAN	67	50	83	83	83	67	67	83	100	83	67	100	83	X=78.2

TABLE S2

SMALL GROUP POST TEST

STUDENT	TEST GRADE (%)
A	80
B	90
C	85
D	55
E	85
F	95

MEAN	81.666666667
MODE	85
MEDIAN	85

STANDARD DEV. 14.023789312

TABLE S3

SMALL GROUP ITEM ANALYSIS POST TEST

OBJECTIVE	ITEM RELATED TO THE OBJECTIVE	100-91%	90-71%	70-51%	UNDER 50%
1a	1	1			
2a	2	2			
3a	3				3
3b	5(A-E)	5(A-E)			
3c	9(A-E) & 6(B-C)	6(B-C)	9(A-E)		
4a	4			4	
4b	7(A-E)			7(A-E)	
4c	8(A-E)			8(A-E)	
5a	6(A-E)&9(A-E)	6(A-E)	9(A-E)		
5b	11.1				11.1
5c	11.2				11.2
5d	10(A-E)	10(A-E)			
5e	11.3	11.3			

TABLE S4

SMALL GROUP QUESTIONNAIRE RESULTS

	A				B			C			D						E	
STUDENT	1	2	3	4	1	2	3	1	2	3	1	2	3	4	5	6	1	2
A	4	5	5	5	5	5	5	4	4	5	5	5	5	2	2	4	4	5
B	4	4	5	5	4	4	4	4	5	5	4	5	4	2	3	4	4	5
C	5	4	5	4	5	3	4	4	4	3	4	2	4	1	2	3	5	5
D	3	4	4	3	5	4	5	5	5	3	4	5	5	4	1	5	5	4
E	4	4	5	4	5	5	5	5	5	5	5	5	4	2	3	4	5	5
F	4	5	5	4	4	3	5	5	4	5	5	4	5	2	2	5	5	5
MEAN	4	4	5	4	4.67	4	5	4.5	5	4	4.5	4	5	2	2	4	5	5

5 STRONGLY AGREE
4 AGREE
3 NO OPINION
2 DISAGREE
1 STONGLY DISAGREE

TABLE S5

SMALL GROUP EVALUATION OF PROJECTS

STUDENT	PROJECT				
	1.1	1.2	1.3	1.4	2
A	X	X	X	X	X
B	X	X	X	X	X
C	X	X	X	X	X
D	X	X	X	X	X
E	X	X	X	X	X
F	X	X	X	X	X

X = COMPLETED ASSIGNMENT

TABLE S6

SMALL GROUP ATTENDANCE SUMMARY

STUDENT	BEFORE MATERIAL WAS PRESENTED			AS MATERIAL WAS PRESENTED		
	DAYS	ABSENT FROM CLASS	CUTS	DAYS	ABSENT FROM CLASS	CUTS
A	8	0	0	8	0	0
B	8	0	0	8	0	0
C	8	0	0	8	0	0
D	8	5	2	8	0	0
E	8	3	0	8	0	0
F	8	1	0	8	0	0
MEAN		1.5	0.33333333		0	0

TABLE F1

FIELD GROUP PERFORMANCE CHECKLIST

STUDENT	OBJECTIVE													PERCENT OF OBJ. PASSED BY STUDENT
	1A	2A	3A	3B	3C	4A	4B	4C	5A	5B	5C	5D	5E	
A			X	X	X									23
B		X	X	X	X		X	X	X	X	X	X	X	77
C	X	X	X	X	X	X	X	X	X	X	X	X	X	100
D	X	X	X	X			X		X	X	X	X	X	77
E	X	X	X	X	X	X			X	X	X		X	77
F	X	X	X	X	X	X	X	X	X	X	X	X	X	100
G	X	X	X	X	X	X	X	X	X	X	X	X	X	100
H	X	X	X	X	X	X		X	X	X	X	X	X	92
I	X	X	X	X	X	X		X	X	X	X	X	X	92
J					X	X	X	X	X		X	X		62
K	X		X	X	X	X	X	X	X	X	X	X	X	92
L	X		X	X	X	X	X	X		X	X	X	X	85
M	X	X	X	X	X	X	X	X	X	X				69
N	X	X	X	X	X	X	X	X	X	X	X	X	X	100
MEAN	79	71	93	93	93	71	79	79	86	79	79	86	79	81.87

TABLE F2

FIELD GROUP POST TEST

STUDENT	TEST GRADE (%)
A	35
B	75
C	65
D	88
E	90
F	70
G	82
H	95
I	78
J	86
K	90
L	81
M	95
N	95

MEAN 80.35714285
MODE 90,95
MEDIAN 82
STANDARD DEV. 16.070073203

TABLE F3

FIELD GROUP ITEM ANALYSIS POST TEST

OBJECTIVE	ITEM RELATED TO THE OBJECTIVE	100-91%	90-71%	70-51%	UNDER 50%
1a	1	1			
2a	2		2		
3a	3		3		
3b	5(A-E)	5(B-E)	5A		
3c	9(A-E) & 6(B-C)	9(A-B)&6(B-C)		9(C-E)	
4a	4	4			
4b	7(A-E)			7(A-E)	
4c	8(A-E)			8(A-E)	
5a	6(A-E)&9(A-E)	6(A-E)&9(A-B)		9(C-D)	
5b	11.1	11.1			
5c	11.2				11.2
5d	10(A-E)			10(A-E)	
5e	11.3	11.3			

TABLE F4

FIELD GROUP

QUESTIONNAIRE RESULTS

	A				B			C			D						E	
STUDENT	1	2	3	4	1	2	3	1	2	3	1	2	3	4	5	6	1	2
A	4	5	5	3	4	4	5	4	4	5	5	5	5	2	4	4	4	4
B	4	4	5	4	5	4	2	5	5	5	4	4	4	2	3	4	4	2
C	2	4	5	4	5	3	3	4	4	1	4	2	4	1	2	1	5	4
D	1	4	4	3	5	5	5	5	5	5	4	5	4	4	1	3	5	5
E	4	4	3	4	5	5	5	5	5	5	4	5	4	2	3	4	4	5
F	4	5	5	4	4	2	2	5	5	5	3	4	5	2	2	5	4	5
G	4	4	4	4	5	4	3	4	4	5	4	4	4	2	2	4	4	4
H	4	5	5	5	5	5	5	4	5	5	3	3	4	3	3	4	5	5
I	3	4	2	3	3	3	4	3	2	2	3	3	3	2	1	3	3	3
J	4	4	4	2	2	4	3	4	4	4	5	4	5	2	2	3	4	4
K	4	5	3	5	5	5	5	4	3	2	4	4	5	3	2	4	4	4
L	3	4	1	4	5	4	5	2	4	2	4	2	4	1	1	4	4	4
M	3	3	3	1	5	5	3	5	5	4	4	5	3	3	3	3	4	3
N	3	4	4	5	5	4	4	4	4	5	3	5	3	2	2	4	4	4
MEAN	3.4	4	4	4	4.5	4	3.8	4.2	4	4	3.9	4	4	2	2	4	4.2	4

5 STRONGLY AGREE
4 AGREE
3 NO OPINION
2 DISAGREE
1 STONGLY DISAGREE

TABLE F5

FIELD GROUP EVALUATION OF PROJECTS

STUDENT	PROJECT				
	1.1	1.2	1.3	1.4	2
A	X	X	X	X	X
B	X	X	X	X	
C	X	X	X	X	X
D	X	X	X		
E	X	X	X	X	
F	X	X	X	X	X
G	X	X	X	X	X
H	X	X	X	X	X
I	X	X	X	X	X
J	X	X	X	X	X
K	X	X	X	X	X
L	X	X	X	X	X
M	X	X	X	X	X
N	X	X	X	X	X

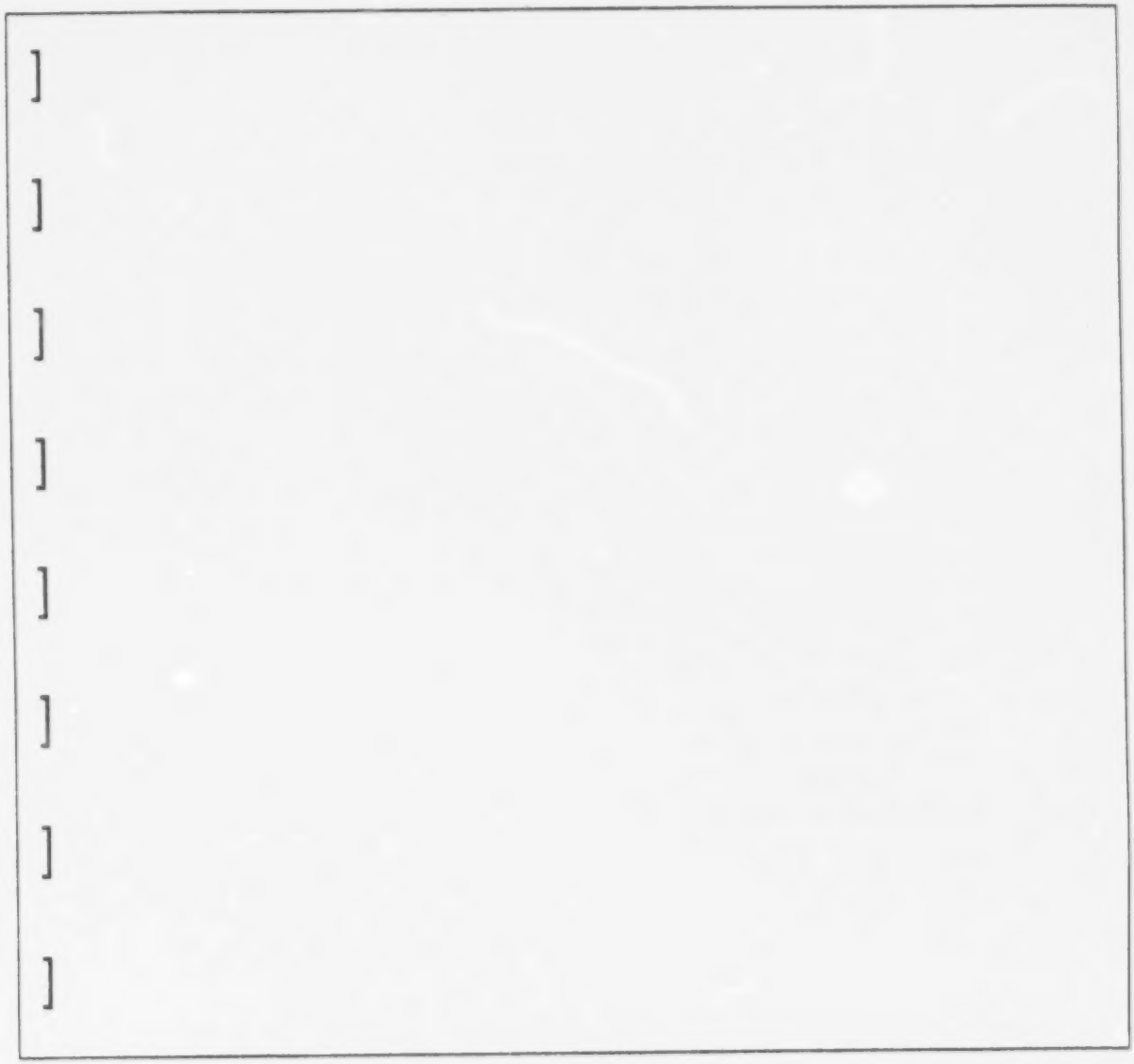
TABLE F6

FIELD GROUP ATTENDANCE SUMMARY

STUDENT		BEFORE MATERIAL WAS PRESENTED			AS MATERIAL WAS PRESENTED	
	DAYS	ABSENT FROM CUTS		DAYS	ABSENT FROM	
CUTS			CLASS			
CLASS						
A	15	6	6	15	3	2
B	15	5	3	15	4	2
C	15	8	2	15	3	3
D	15	5	3	15	7	2
E	15	9	7	15	4	0
F	15	1	0	15	3	0
G	15	2	0	15	0	0
H	15	1	0	15	0	0
I	15	0	0	15	0	0
J	15	4	4	15	2	1
K	15	8	7	15	1	1
L	15	12	11	15	1	1
M	15	1	1	15	3	1
N	15	9	8	15	2	0
MEAN		5.0714	3.7143		2.3571	0.9286

Appendix 10
Improved Instructional and Evaluation Materials

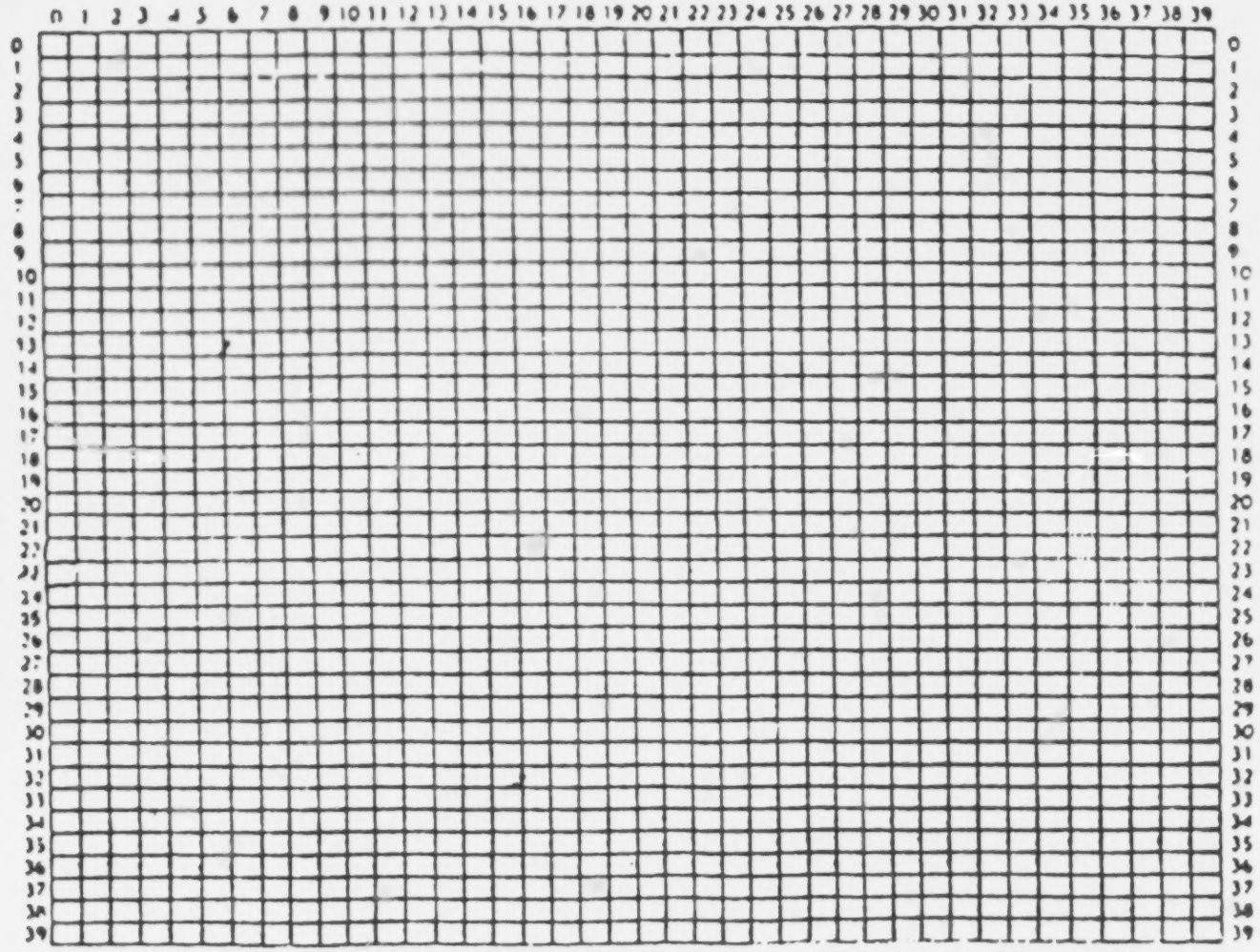
NORMAL TEXT MODE



SCREEN DIMENSIONS
HORIZONTAL: 40 SPACES ACROSS
NUMBERED FROM 1 TO 40
VERTICAL: 24 LINES FROM TOP TO BOTTOM
NUMBERED 1 TO 24

GRAPHIC MODE

TO SWITCH THE SCREEN FROM NORMAL TEXT MODE TO LOW RESOLUTION GRAPHIC MODE TYPE [GR] AND PRESS RETURN.



ONLY THE LAST THREE LINES OF TEXT WILL BE SEEN IN GRAPHICS MODE

TO RETURN THE SCREEN TO NORMAL TEXT MODE ENTER

[TEXT : HOME]

AND PRESS RETURN

COLOR CHART

The command to select a color is

COLOR = (# OF COLOR SELECTED)

There are 16 colors available, represented by the numbers 0 to 15.

0	**BLACK**
1	**MAGENTA (RED)**
2	**DARK BLUE**
3	**VIOLET**
4	**DARK GREEN**
5	**GRAY -1**
6	**MEDIUM BLUE**
7	**LIGHT BLUE**
8	**BROWN**
9	**ORANGE**
10	**GRAY -2**
11	**PINK**
12	**GREEN**
13	**YELLOW**
14	**AQUA**
15	**WHITE**

Example:

To select the color green enter,

COLOR = 12

PLOT

The PLOT command is used to draw a single point or a group of points in a diagonal. The plot command will draw only one square of the grid at a time.

PLOT x, y

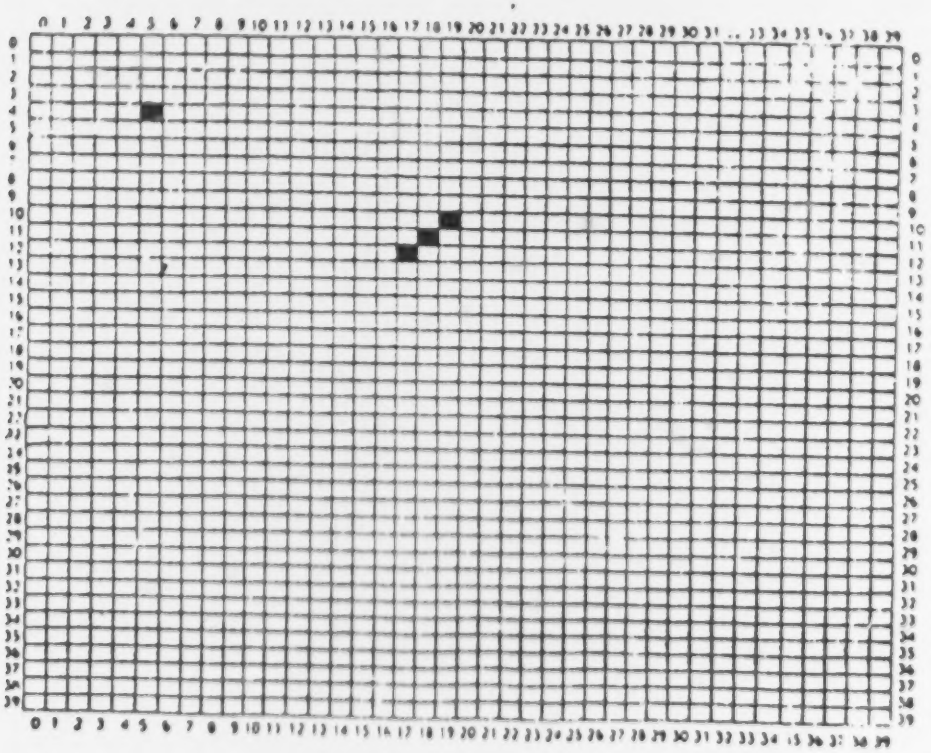
X: The x value is the horizontal number on the top or bottom of the chart.

Y: The Y value is the vertical number on the sides of the chart.

Example :

A) PLOT 5,4

B)
```
PLOT    17,12
PLOT    18,11
PLOT    19,10
```



HLIN

The HLIN command is used to draw two or more horizontal grids at a time.

HLIN x1,x2 AT y

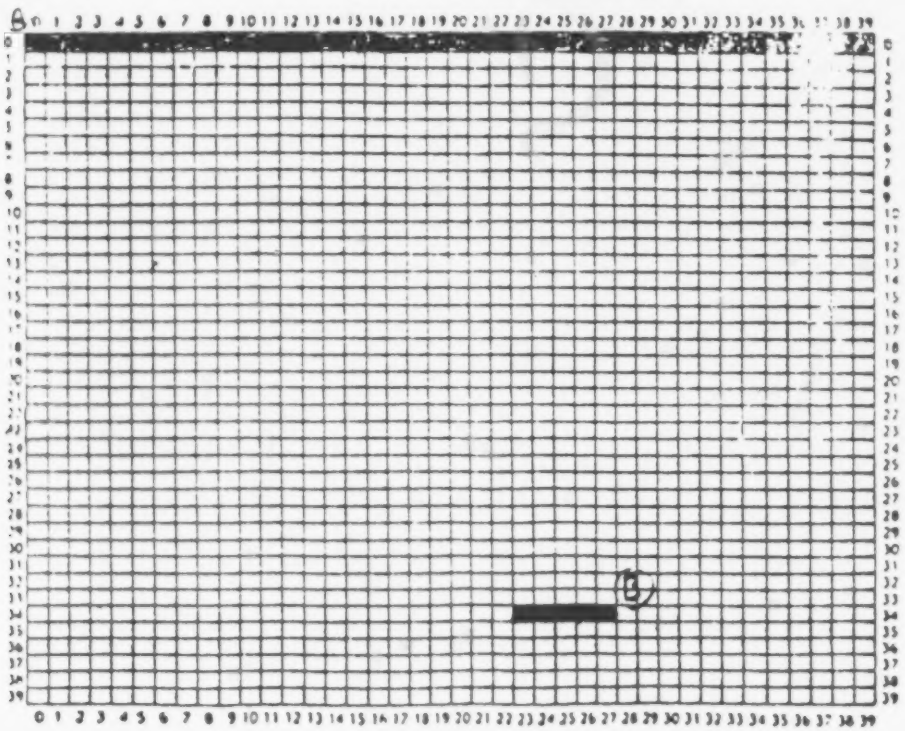
x1: The x value for which the horizontal line starts.

x2: The x value for which the horizontal line ends.

y: The value which states on which vertical line it will appear.

Example:

A) HLIN 0,39 AT 0 B) HLIN 23,27 AT 34



VLIN

The VLIN command is used to draw two or more vertical grids at a time.

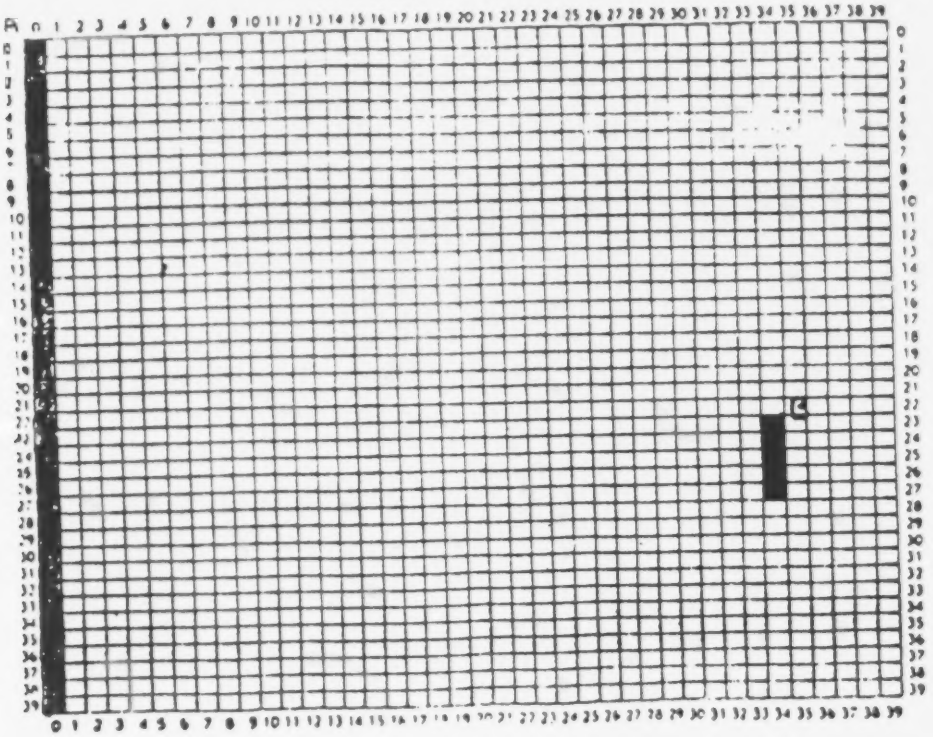
VLIN y1,y2 AT x

y1: The y value for which the vertical line starts.

y2: The y value for which the vertical line ends.

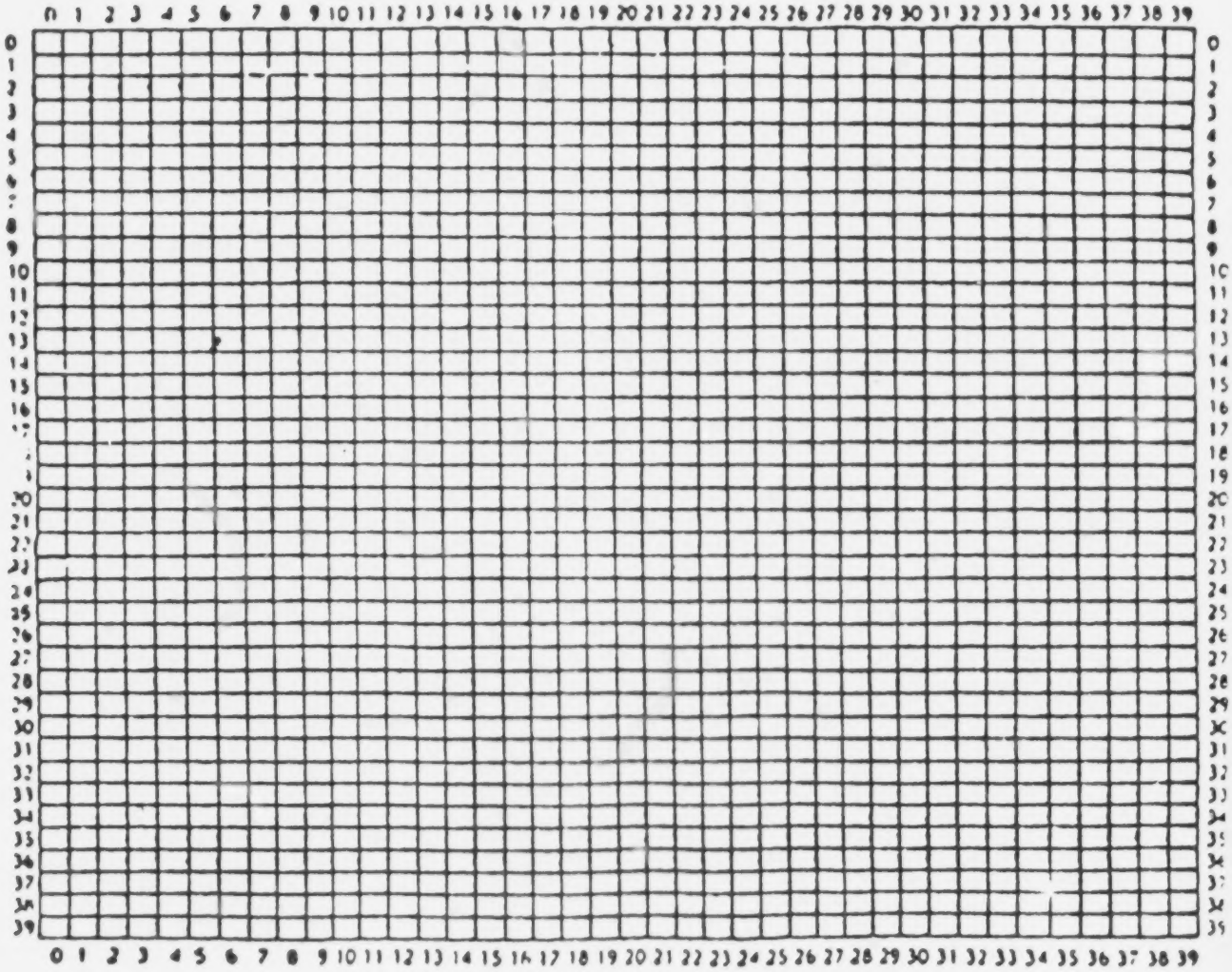
x: The value which states on which horizontal line it will appear.

Example:
A) VLIN 0,39 AT 0 B) VLIN 23,27 AT 34



GRAPHIC WORKSHEET :

Use this sheet to assist you in the planning and programming of your graphic design.



LESSON 1: Low Resolution Graphics

AIM: What is Apple Graphics?

PERFORMANCE OBJECTIVES: (The student will be able to ....)

1. Type the command to switch the screen from text to graphics mode.
2. Select a color to draw with using the COLOR = # command.
3. Determine whether a point or a group of points is a line or a single point.
4. Distinguish between a horizontal or a vertical line.
5. Identify the X and Y axis on the graphic grid.
6. Use the Plot command to place points on the screen.

DO NOW: Load the demonstration program into the computer and RUN the program.

DEVELOPMENT:

1. Allow students to work through program, assist students who are having problems.
   a. Have students comment on the program,.
   b. Ask: How would you like to create designs of your own on the computer? Inform students that in a matter of days they well be able to do so.
2. Introduce the GR command.
   a. Have students type GR in and press RETURN.
   b. Discuss what they think has occurred.
   c. On overhead show example of normal screen, place example of graphics screen on top. This gives an example of what occurs when the GR command is entered.
   d. Elicit: The GR command switches the text screen for the graphic screen.
3. Introduce the TEXT: HOME COMMAND.
   a. Have students enter TEXT: HOME and press return.
   b.Elicit: The TEXT:HOME command switches. The screen from the graphic mode to normal or TEXT mode.
4. Inform the student that to create graphic, they have to first turn the computer screen into graphic mode and, second, select a color.
   a. Show color chart on overhead.
   b. Explain the number is the code for the color.
   c. The way we select a color is COLOR = #.
   d. Have students enter COLOR = #.

e. Ask: What happened? Explain: It appears nothing happens because the COLOR = command only selects a color it does not draw. The process that did occur is the color to work with is in memory.

5. Distribute the graph worksheet.
   a. Have example of it on overhead.
   b. Explain that in graphic mode the computer breaks the screen down to a 40 x 40 screen; the columns and rows are numbered 0 to 39.
   c. Using the overhead have students take notes and refer to their own graph.
6. Show the difference between a point, and line.
   a. Any single point or group of points in a diagonal are considered to be separate points in low resolution graphics.
   b. Any two or more points together vertically, or horizontally, are lines.
7. Give examples between horizontal and vertical lines.
8. Point out and have students label X and Y axis.
   a. The lines going from left to right are x axis.
   b. The lines going up and down are y axis.
9. Explain how to draw a point.
   a. Introduce the PLOT x, y command.
      1. To use the plot command, you must determine the x value and y value of a point. x = 19 y = 20.
      2. Color in one grid on the overhead graph.
         a. Have students determine the x value.
         b. Have students determine the y value.
      3. Have students turn on computers and enter PLOT 19, 20.
         a. Why didn't it work?
            1. Always enter the GR first.
            2. Select a color.
            3. Then draw.
         b. Have students do above and try again.
            1. Ask: Does it appear in the same areas as the overhead?

10. Color in other grids and have students plot out points.

APPLICATION:

1. Have student switch from GRAPHIC to TEXT screen.
2. Have students enter the color command, then type PLOT O,O. Explain: The color they select should appear in a dot in the upper left corner.

3. PLOT a different color point in each corner of the screen.

SUMMARY:

How do we get to the Graphic screen?
How do we get to the TEXT screen?
How do we select a color to draw with?

Lesson 2: Low Resolution Graphics

AIM: How do we draw lines?

PERFORMANCE OBJECTIVES: To Be Able To :
1. Use the HLIN and VLIN command to draw horizontal and vertical lines.
2. Determine which command should be used between PLOT, HLIN, VLIN/

DO NOW /MOTIVATIONS:
1. Hand out graphs with points. Draw on them. Have students:
a. Determine the x and y coordinates;
b. Create a program that will draw them on the computer in the color of the number next to it.

DEVELOPMENT:

1. Go over do now problems. As students are working on programs, assist students individually or in small groups.
2. Ask students to draw on graph across the top of screen.
Ask: 1. How would we have to have this drawn on the computer?
a. Write on board the responses. PLOT O,O , PLOT 1,0 , PLOT 2,0.
b. Ask: "Wouldn't it be nice if there was one command to do?"

Ask: "What is two or more points that go from left to right across the screen?"
Elicit: " HORIZONTAL LINE"

Explain: how to create a horizontal line as

COMMAND	1ST POINT ,	2ND POINT	at	Y level
HLIN	O,	39	at	O

Have students enter and see what it does.

3. Do same as 2, after having students draw a line up and down left side of screen on graph.
ELICIT: " VERTICAL LINE"

Explain: How to create a vertical line as command.

COMMAND	1ST POINT	2ND POINT	at	x point
VLIN	O,	39	at	0

4. Have student use the command to finish a border around the screen.

APPLICATIONS:

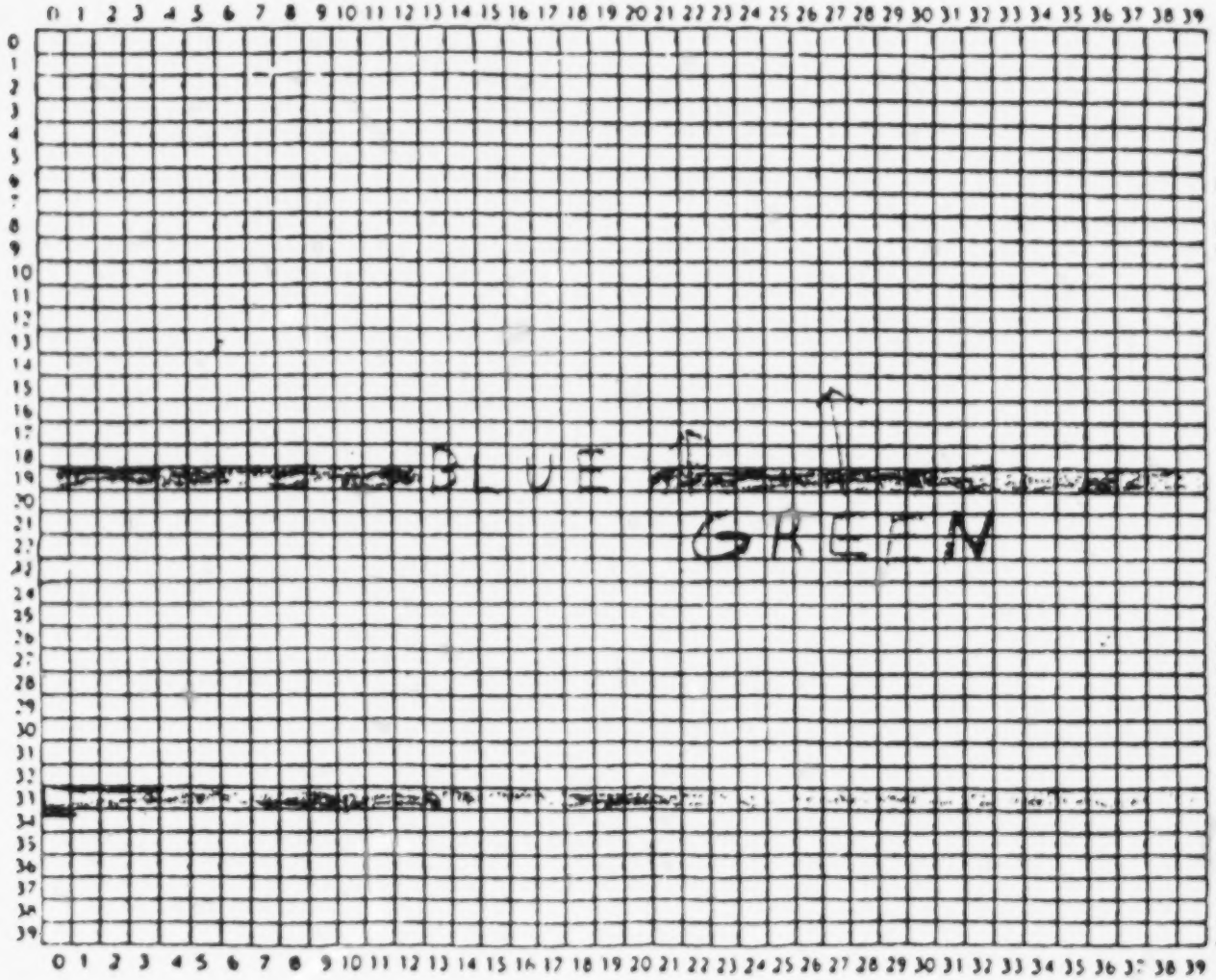
1. Hand out work sheet with lines and points and have students write a program to draw each line / point a different color.
2. As students work on sheets, circulate and assist students.

SUMMARY:

How do we draw HORIZONTAL LINES?
How do we draw VERTICAL LINES?

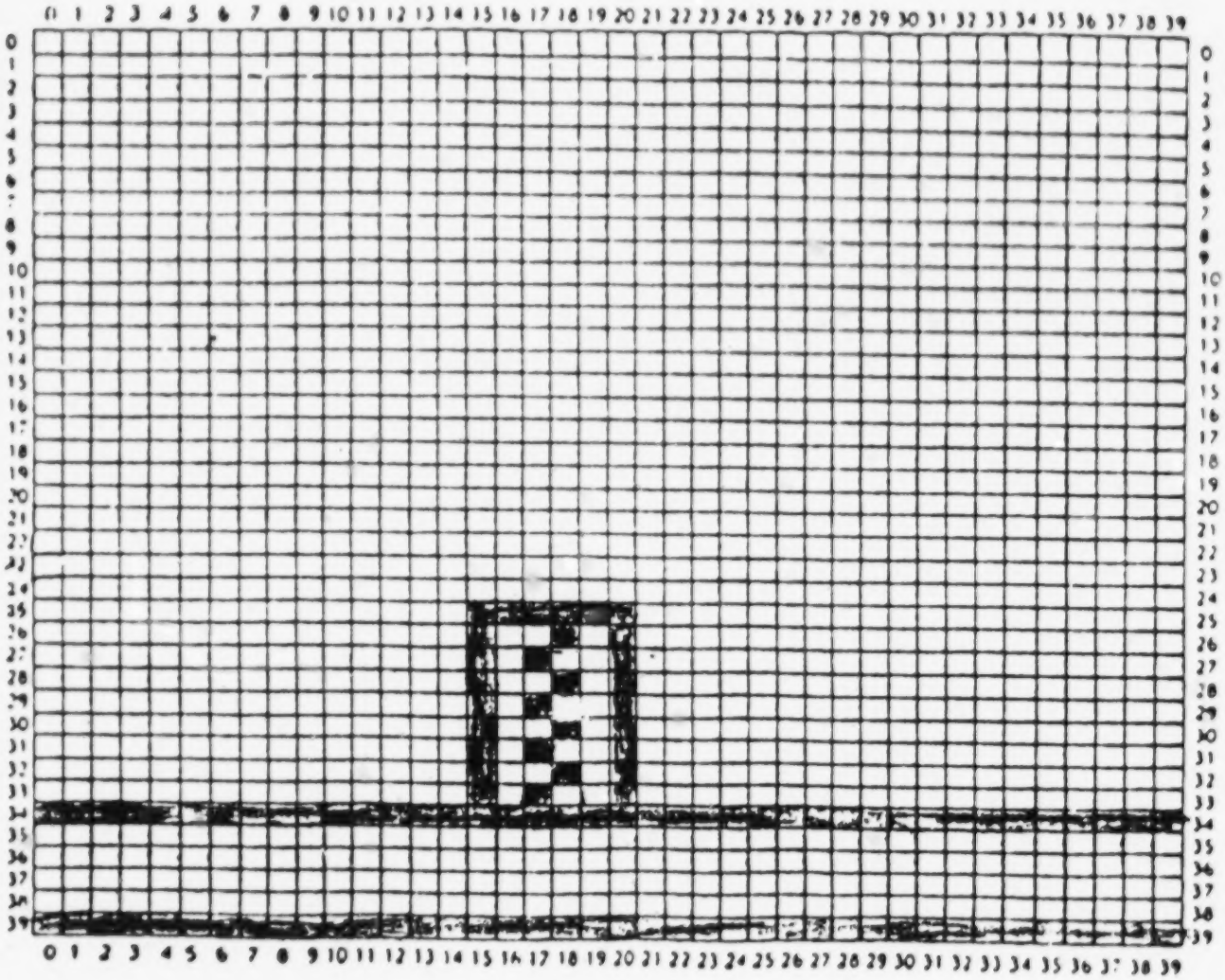
PROJECT 1.1

Write a program that will create the design drawn in the graph below. Number the line numbers in you program between 1 and 300. Save the program to your diskette, call the program **graph1.**



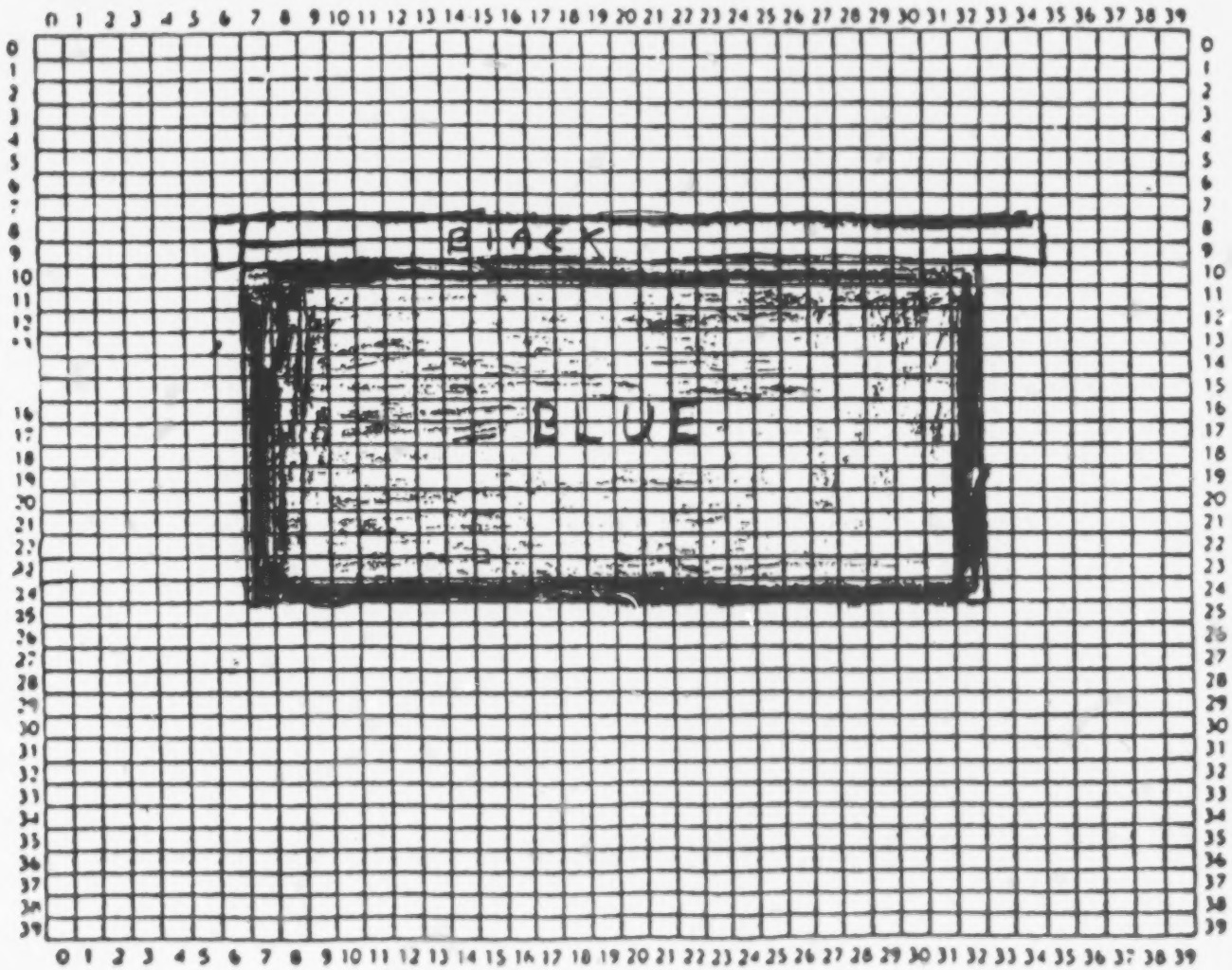
PROJECT 1.2

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 301 and 500. Save the new program to your diskette using the same name **graph1.**



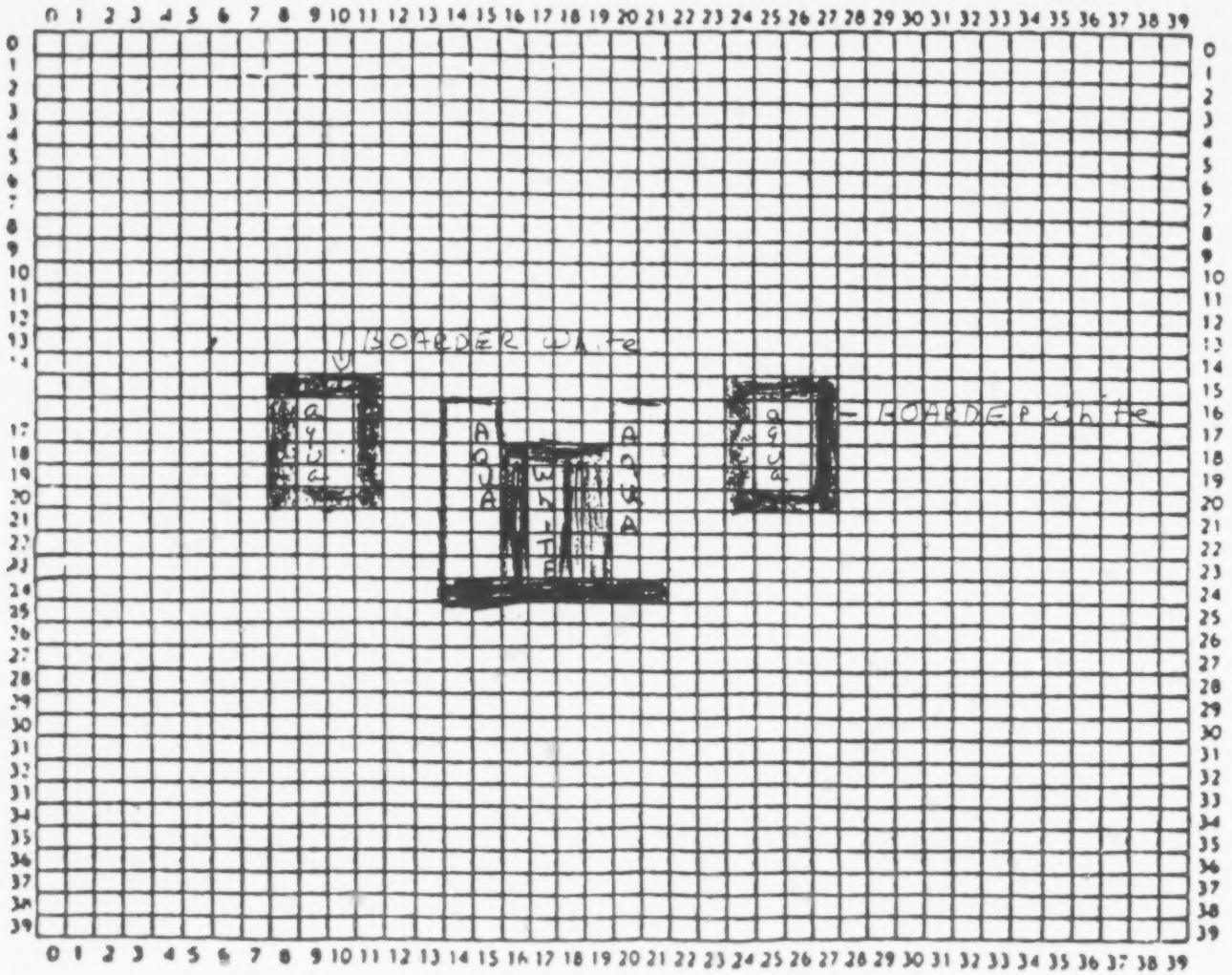
PROJECT 1.3

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 501 and 700. Save the new program to your diskette using the same name **graph1.**



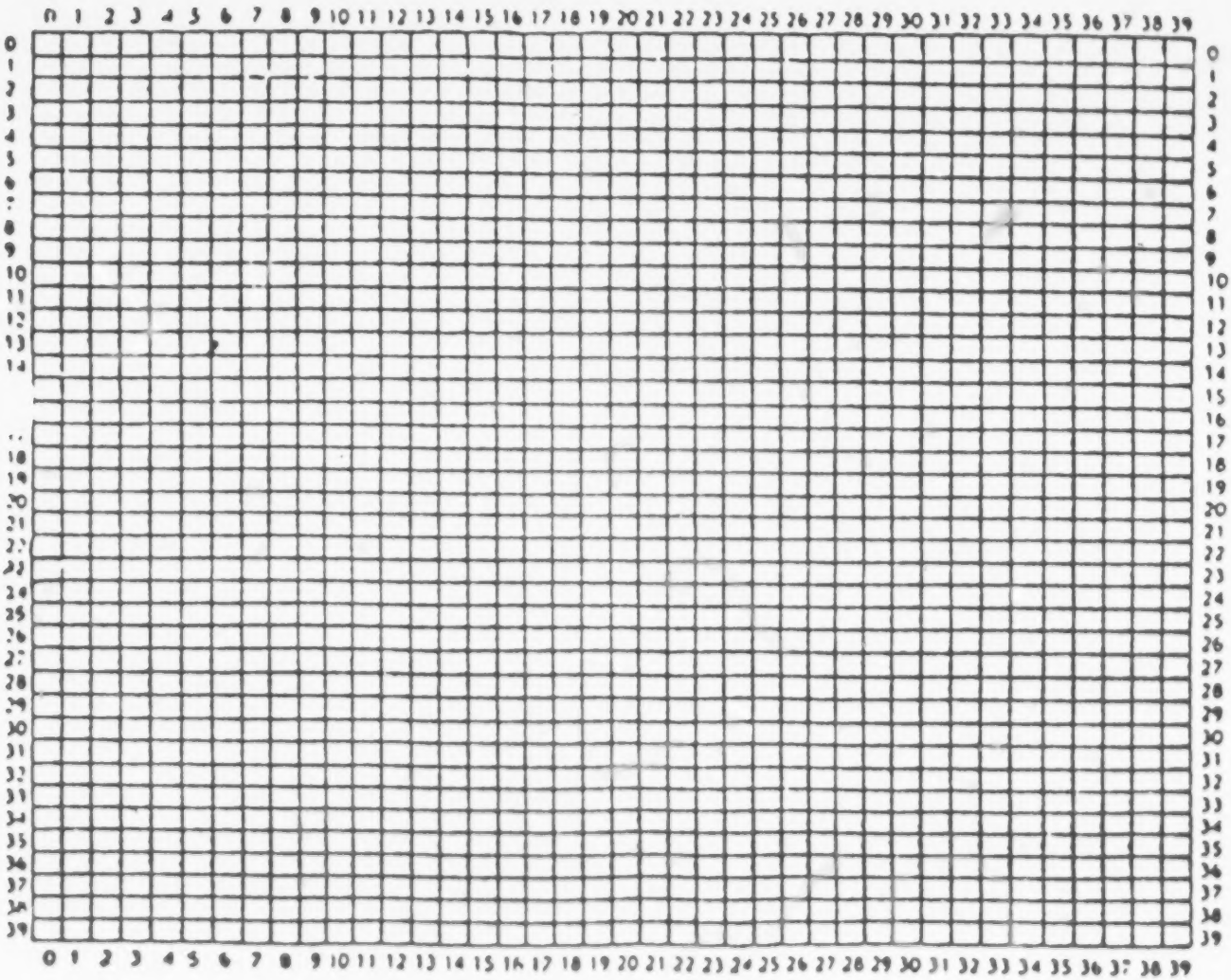
PROJECT 1.4

Retrieve the file **graph1** and add to the program so that it will add the design drawn in the graph below. Number the lines in your program between 701 and 1000. Save the new program to your diskette using the same name **graph1.**



PROJECT 2

Draw your own design on the graph provided below, then write the program that will generate the design on the computer.



PERFORMANCE CHECKLIST

TASK: Given access to an Apple IIe computer and a pre-created graphed drawing, the student will be able to write a structurally sound BASIC language program using the command HLIN, VLIN, and PLOT to create the design on the graph.

STUDENT NAME _____DATE ___/___/ 89

Directions : Enter a G (GO) or NG (NO GO) to indicate whether the student performs each task as indicated.

1. ___ Types the command GR when asked to switch screen from text to graphics mode.

2. ___ Types the command TEXT:HOME when asked to change the screen from graphic to text mode.

3. ___ Enters the COLOR = # command when asked to select a color.

4. ___ Identifies correctly 5 of 6 times whether an item on the graph is a point or line.

5. ___ Identifies correctly 5 of 6 times whether a line is vertical or horizontal.

6. ___ Correctly labels the X and Y axis of the graph.

7. ___ Correctly states the X value of a point on the graph.

8. ___ Correctly states the Y value of a point on the graph.

9. ___ Identifies 5 of 6 times the correct command to draw a specific point or group of points.

10. ___ The student, once given a design on the graph, is able to break the design into major sections using color and shape.

11. ___Student outlines the order to which each section should be entered in the program.

12. ___Uses the correct command and coordinate values to create a particular section of the graph.

13. ___Uses the command created in 12 and places them in program form in the proper order to create the design.

POST TEST

SECTION: Graphics

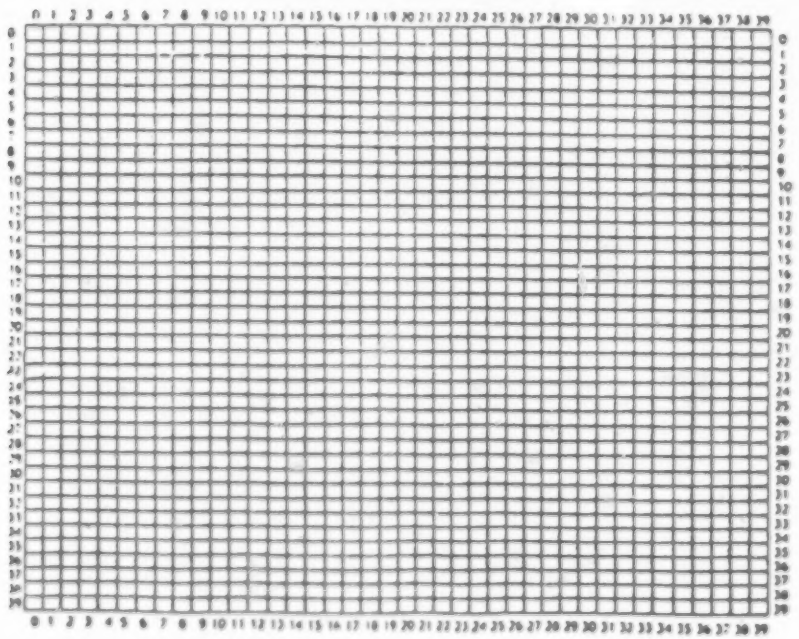
NAME _____ DATE _____

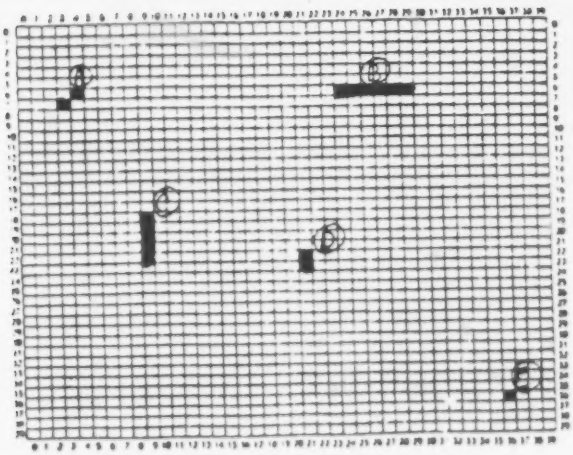
1. What command must you enter to switch the Apple IIe's screen from text to graphic mode? _____

2. How do you switch the screen from graphic to normal mode? _____

3. State how you would select drawing in light blue from magenta

4. Using the graph provided below label the x and y axis.





Use the graph above to answer questions 5 and 6.

5. Identify each item on the graph as a point or a line.

A)_____

B)_____

C)_____

D)_____

E)_____

6. Determine the best command to use to draw each item.

A)_____

B)_____

C)_____

D)_____

E)_____

7. Determine the X value of the points A thru E on the graph below.

A)_____

B)_____

C)_____

D) _____

E) _____

8. Determine the y value of the points F thru J on the graph below.

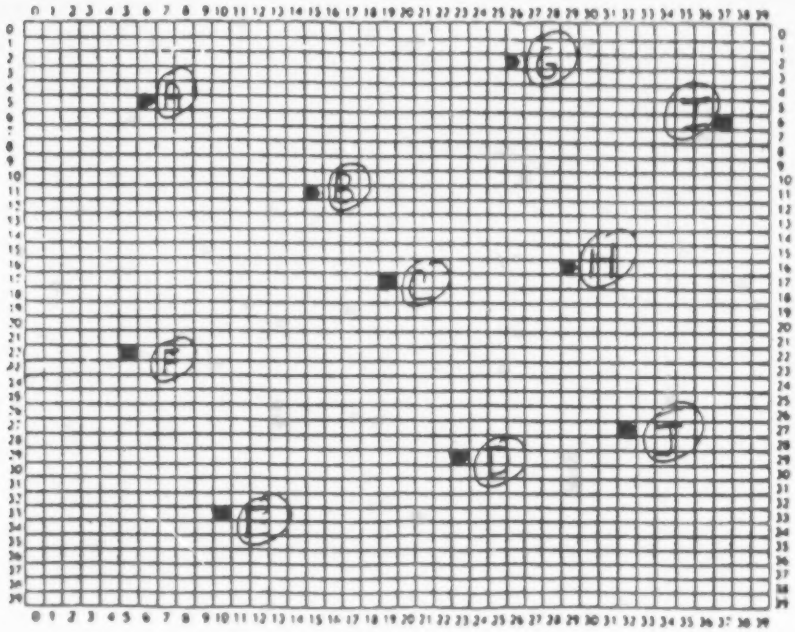
F)_____

G)_____

H)_____

I)_____

J)_____



9. Write the command that would draw each of the items in the graph below.

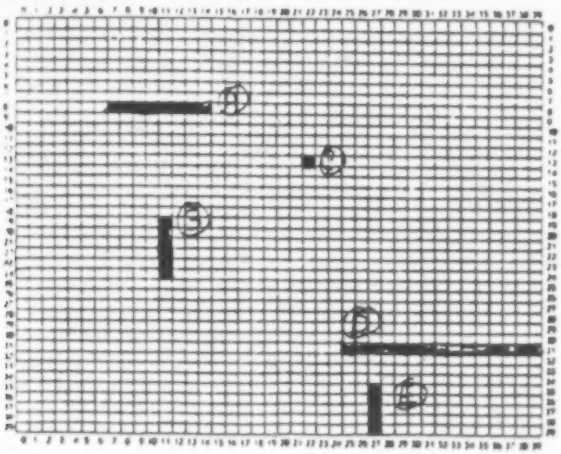
A)_____

B)_____

C)_____

D)_____

E)_____



10. Draw on the graph what each of the following commands would create on the screen.

A) PLOT 7,9

B) VLIN 4,5 AT 31

C) VLIN 1,39 at 39

D) HLIN 12,15 AT 30

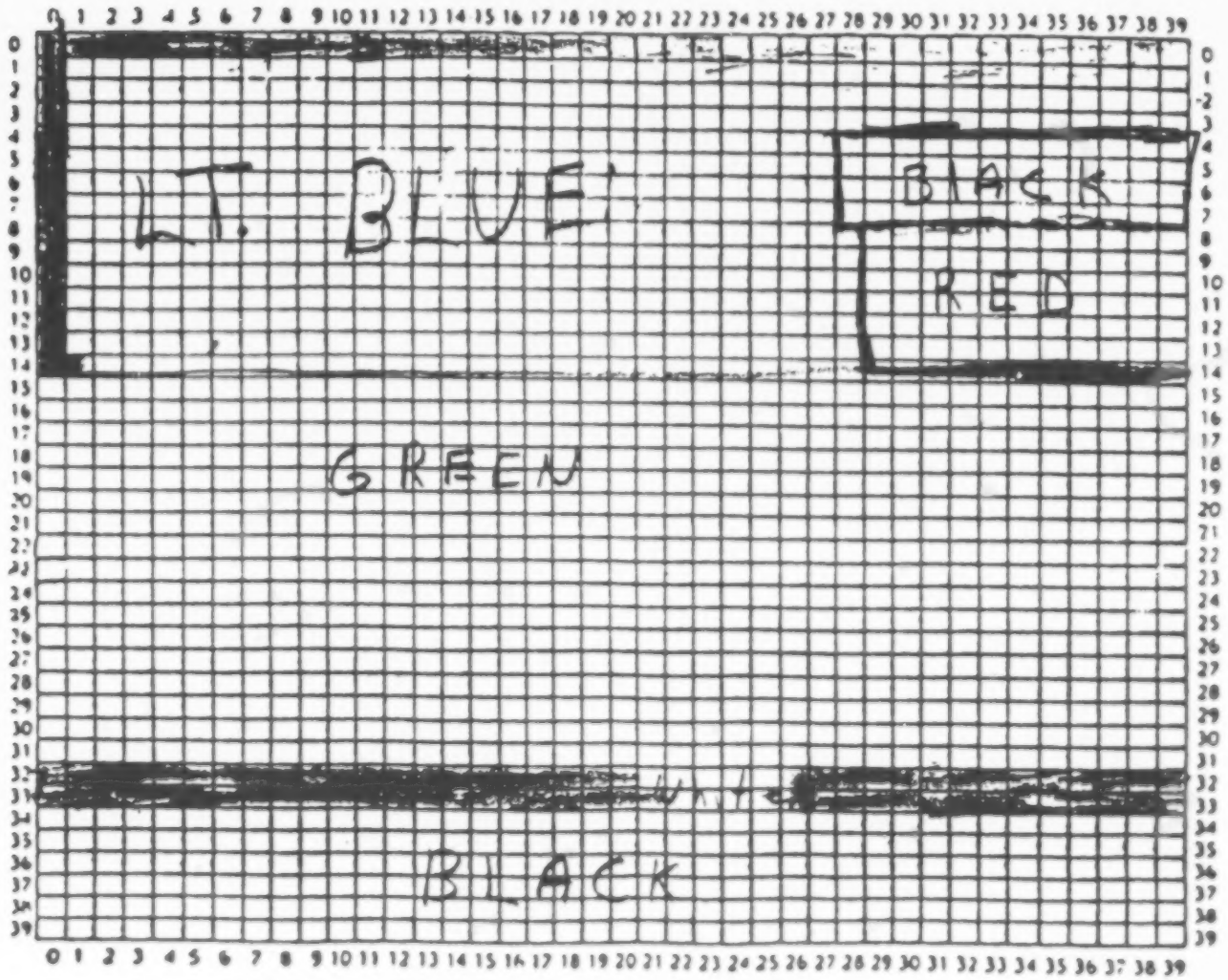
E) PLOT 34,36

11. Using the design on the graph determine how you would write the program that would produce the design.

1) Break the design into sections according to size and color.

2) State the order you would use to enter each part. Explain your selection of the order.

3) Write the program that would produce the design.



Attitude Questionnaire

Check how many of the projects did you complete?

___ 0 _____1-2 _____ 3-4 _____ 5

Check the range you scored on the Exam.

___Below 40 ___41-55 ___56-65 ___66-80 ___81-90 ___91 & Above

Circle the the answer that best suits your opinion of the question:

1. Strongly Disagree
2. Disagree
3. No Opinion
4. Agree
5. Strongly Agree

A. Motivation

1) Did you like the beginning demonstration?

1 2 3 4 5

2) Do you like creating graphic images on the computer?

1 2 3 4 5

3) Would you like to spend more time working with graphics?

1 2 3 4 5

4) Did the demonstration and instruction make you want to create you own design?

1 2 3 4 5

5) What do you feel would have made the demonstration better?

B. Objectives:

1) Do you understand how to switch the screen between it two modes?

1 2 3 4 5

2) Did you understand that you would be learning the difference between the three graphic commands and how to use them?

1 2 3 4 5

3) Did you want to learn more about computer programming?

1 2 3 4 5

C. Test

1) Do you think the items on the performance checklist were clear?

1 2 3 4 5

2) Do you think most of the questions on the test were clear?

1 2 3 4 5

3) Did you understand what you had to do in project 1?

1 2 3 4 5

4) If you were not happy with either the Checklist, Test, or Project explain why.

D. Instruction

1) Was the instruction interesting?

1 2 3 4 5

2) Was the instruction clear?

1 2 3 4 5

3) Were the examples helpful?

1 2 3 4 5

4) Were there too many example?

1 2 3 4 5

5) Were there too few examples?

1 2 3 4 5

6) Did the practice questions help you?

1 2 3 4 5

If not, why not?

7) What could have been done to make the instruction better?

E) Overall

1) Generally, did you like the lesson?

1 2 3 4 5

2) Did you learn to do things you couldn't do before?

1 2 3 4 5

3) What do you think could be done to improve the lesson?

Appendix 11
Instructional Material Locater

INSTRUCTIONAL MATERIAL LOCATOR

The Instructional Computer diskette and overhead transparencies that were produced in this project are available at the office of the Masters of Science, in Training and Learning Technology at Old Westbury, N.Y. 11568. The format of the disk is Apple IIe, Dos 3.3 on a $5^1/_4$ inch diskette.

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